Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Vol. XXII August 26, 1931 No. 11

In This Issue

Editorials 24

The Nonmetallic Mineral Resources of Michigan 27

Problems Confronting the Producers of Talc and Allied Minerals 33

A. S. T. M. Committees Announce Research Plans for Next Twelve Months 35

Automatic Dump Cars Simplify Handling of Gravel at Tennessee Plant 39

Sand-and-Gravel Industry Attacks Plan to Increase Freight Rates 44

River Aggregates Produced Economically in Combined Dredge and Barge 49

Derricks Employed to Handle Materials at Southern Gravel Operation 53

Utilization of Finer Sizes of Gravel in Concrete-Highway Construction 57

Three Trains Operate Efficiently Over One Track from Pit to Plant 61

Men of the Industry	69	*Financial News*	78
Coming Events	70	*Review of Foreign Practice*	79
Pumpings from the Old Pit	70	*Recent Patents*	80
New Corporations	70	*Manufacturers' Publications*	81
Personal Mention	71	*Insurance Problems Discussed*	82
Traffic News and Comment	72	*New Machinery and Supplies*	83
Latest Cement Statistics	74	*Legal Information*	86

Next Issue September 9, 1931

Published bi-weekly on Wednesday for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other nonmetallic minerals. Entered as second-class matter October 9, 1928, at the Postoffice at Chicago, Ill., under the Act of March 3, 1879.

Copyright, 1931, by
COMPLETE SERVICE PUBLISHING CO.
538 South Clark St.
Chicago, Ill.

H. W. Baumgartner, *President*
V. E. Larsen, *Vice-President*
S. A. Phillips, *Directing Editor*
W. E. Trauffer, *Asst. Editor*
Harry F. Utley, *Asst. Editor*
Mat F. Beisser, *Asst. Editor*

Editorial Field Representatives:
A. C. Petersen
S. D. Smith
W. A. Renock

Advertising Representatives:
Chicago
W. A. Buschman L. C. Thaon
Telephone *Harrison 9357*
Chicago, Ill.

New York
E. M. Buck, 68-43 Clyde St.
Telephone *Boulevard 8-5259*
Forest Hills, L. I., N. Y.
A. W. Randle, 5 Prospect Place
Telephone *Vanderbilt 3-4801*
New York, N. Y.

Cleveland
W. E. Coates, 1258 Marlowe Ave.
Telephone *Lakewood 1166J*
Lakewood, Ohio

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, Central, and South America; elsewhere (including Canada) $1 additional for each year. Single copies 20 cents.

Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Vol. XXII August 26, 1931 No. 11

In This Issue

Editorials 24

The Nonmetallic Mineral Resources of Michigan 27

Problems Confronting the Producers of Talc and Allied Minerals 33

A. S. T. M. Committees Announce Research Plans for Next Twelve Months 35

Automatic Dump Cars Simplify Handling of Gravel at Tennessee Plant 39

Sand-and-Gravel Industry Attacks Plan to Increase Freight Rates 44

River Aggregates Produced Economically in Combined Dredge and Barge 49

Derricks Employed to Handle Materials at Southern Gravel Operation 53

Utilization of Finer Sizes of Gravel in Concrete-Highway Construction 57

Three Trains Operate Efficiently Over One Track from Pit to Plant 61

Men of the Industry	69	*Financial News*	78
Coming Events	70	*Review of Foreign Practice*	79
Pumpings from the Old Pit	70	*Recent Patents*	80
New Corporations	70	*Manufacturers' Publications*	81
Personal Mention	71	*Insurance Problems Discussed*	82
Traffic News and Comment	72	*New Machinery and Supplies*	83
Latest Cement Statistics	74	*Legal Information*	86

Next Issue September 9, 1931

Published bi-weekly on Wednesday for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other nonmetallic minerals. Entered as second-class matter October 9, 1928, at the Postoffice at Chicago, Ill., under the Act of March 3, 1879.

Copyright, 1931, by
COMPLETE SERVICE PUBLISHING CO.
538 South Clark St.
Chicago, Ill.

H. W. Baumgartner, *President*
V. E. Larsen, *Vice-President*
S. A. Phillips, *Directing Editor*
W. E. Trauffer, *Asst. Editor*
Harry F. Utley, *Asst. Editor*
Mat F. Beisser, *Asst. Editor*

Editorial Field Representatives:
A. C. Petersen
S. D. Smith
W. A. Renock

Advertising Representatives:
Chicago
W. A. Buschman L. C. Thaon
Telephone *Harrison 9357*
Chicago, Ill.

New York
E. M. Buck, 68-43 Clyde St.
Telephone *Boulevard 8-5259*
Forest Hills, L. I., N. Y.
A. W. Randle, 5 Prospect Place
Telephone *Vanderbilt 3-4801*
New York, N. Y.

Cleveland
W. E. Coates, 1258 Marlowe Ave.
Telephone *Lakewood 1166J*
Lakewood, Ohio

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, Central, and South America; elsewhere (including Canada) $1 additional for each year. Single copies 20 cents.

Pit and Quarry

Member Audit Bureau of Circulations

With which is consolidated CEMENT-MILL & QUARRY

Read in Largest Number of Plants

Vol. XXII CHICAGO, AUGUST 26, 1931 No. 11

Arrange Programs for 1931 Safety Congress

MEETS IN CHICAGO, OCT. 12-16

Plans for the Twentieth Annual Safety Congress to be held at the Stevens Hotel Oct. 12 to 16 are rapidly nearing completion, according to announcements from the National Safety Council. Tentative programs for the affair, which annually attracts thousands of leaders who realize the importance of safety in industry, have already been issued.

Of particular interest to PIT AND QUARRY readers are the meetings of the Cement and Quarry Sections. The Cement Section will hold its sessions Tuesday afternoon and Wednesday morning, Oct. 13 and 14. The Quarry Section will meet Thursday, Oct. 15. On the afternoon of Wednesday, Oct. 14, and at luncheon on that day the two sections will hold their customary joint session.

R. B. Fortuin, of the Pennsylvania-Dixie Cement Corp. and general chairman of the Cement Section, will preside at the meeting of that group. Among the addresses scheduled are the following:

"The Relation of Labor Turnover to the Accident Curve," W. L. White, Jr., asst. general manager, Medusa Portland Cement Co., Cleveland, O.

"Accident Investigation from the Employee Point of View," R. A. Finch, safety engineering, Bureau of Safety, Chicago.

"The Advantage of Physical Examination and Re-examination to the Employee," Dr. W. J. Fenton, American Red Cross, Washington, D. C.

"Minimizing Pulverized Coal-Dust Hazards in Cement Mills," Daniel Harrington, chief engineer, Safety Division, U. S. Bureau of Mines, Washington, D. C.

A. L. Worthen, of the Connecticut Quarries Co., Inc., New Haven, Conn., is general chairman of the Quarry Section. Talks to be delivered at the meeting of this section include:

"The Progress of Safety in the Quarry Industry," W. W. Adams, chief statistician, U. S. Bureau of Mines, Washington, D. C.

"The Executive's Viewpoint of Safety in the Quarry Industry," John Prince, president, Stewart Sand & Material Co., Kansas City, Mo.

"The Superintendent's Viewpoint of Safety in the Quarry Industry," E. M. Gould, superintendent, Cape Girardeau plant, Marquette Cement Manufacturing Co., Cape Girardeau, Mo.

Pay Royalty for Gravel Used on State Highways

Producers of aggregates and contractors who use sand and gravel taken from Oregon streams in the construction of state highways will be compelled to pay royalty to the state on the basis of 10 cents a cubic yard, according to a decision reached at a meeting of the state land board at Salem, Ore., early this month.

Under a previous ruling of the board, sand and gravel used in highway construction was exempted from the payment of royalty.

Plans to Rebuild Lime Plant Damaged by Fire

The St. Joe Lime & Stone Co., of St. Joe, Ark., is planning to rebuild part of its plant which was destroyed by fire on July 30 with loss of about $100,000 including machinery. The company is an interest of the Eastern Arkansas Lumber Co. of St. Joe, of which J. W. Treischman of Little Rock is president.

Signs of Recovery

(Extracted from items appearing in this issue.)

BESSEMER, PA.—One hundred men return to work at plant of Bessemer Limestone & Cement Co. . . . BIRMINGHAM, ALA.—Alabama Concrete Pipe Co. resumes full-time operations with orders on hand for capacity production until end of year. . . . AUSTIN, TEX.—State highway department awards nearly $5,000,000 worth of contracts for road building in addition to present program. . . . METALINE FALLS, WASH.—For first time in years Lehigh Portland Cement Co. will not close down for summer months because of brisk demand for cement. . . . MARGERUM, ALA.—First six months business of Alabama Asphaltic Limestone Co. exceeds that of entire year in 1930.

California Lime Co. May Produce Cement

NEW INTERESTS BUY CONTROL

Reorganization of the Cajon Lime Products Co. and reopening of that concern's plant and quarry in Cajon Pass about 15 miles northwest of San Bernardino, Cal., are planned by new interests who have acquired control of the holdings. Plans for renewal of operations at the lime plant, and expansion to include cement manufacture are also reported.

Loren Foreman, senior partner of the nationally-known clothing firm of Foreman & Clark, is said to have acquired control of the Cajon Lime Products Co. It is reported from reliable sources that Mr. Foreman and a group of associates will commence operation of the plant and quarry near San Bernardino sometime in September.

Plans for reopening of the plant are said to call for start of operations limited to manufacture of lime, with development of a cement plant slated to follow when the lime business is well established according to the *San Bernardino Telegram.*

To Erect Huge Storage Bins at Port Homer, O.

The Eastern Ohio Sand & Supply Co. of East Liverpool, O., has been granted a permit by the U. S. Engineering Dept. for the erection of two steel storage bins, each 118 ft. square, on the Ohio River front at Port Homer, O., according to Albert E. Frosch, general manager.

The company recently was awarded a contract to supply 10,000 tons of sand and gravel for state-highway work.

Stone-Washing Equipment Installed at Ohio Plant

Work of installing equipment for washing crushed stone at the Hopewell Center stone quarry, near Tiffin, O., which has been in progress for some time has been completed. Hereafter the state of Ohio will require washed stone on much of its highway work and the plant installed the additional equipment to meet the specifications.

Hearing on Freight—Rate Rise Resumes

EXPLAIN PRESENT MORATORIUM

The final hearing in Ex Parte 103, the carriers application for permission to increase freight rates, is scheduled to begin Aug. 26 at Chicago. It is likely that this hearing will be completed not later than Sept. 5, as Secretary McGinty has advised that there may be two Chicago hearings running concurrently and that all parties desiring to offer evidence there should be prepared to proceed at any time after the opening of the hearing. Printed briefs must be filed within ten days after the close of the final hearing. From the increased activity in these proceedings it is expected that the commission will render its decision not later than Oct. 15, and if increases are granted will allow them to be published on short notice.

If any increase is granted it seems certain that the carriers will not take advantage of it in increasing the short-haul rates on crushed stone, sand and gravel, judging from the reductions proposed by the carriers to meet motor-truck competition noted in this issue under "Rate-Committee Dockets" in the Traffic News Department. The traffic which does not lend itself readily to motor-truck shipment will bear the increase, but the number of commodities coming in that class is rapidly diminishing. Coal has been considered one of the things that must be moved by rail, yet industries as far as 125 mi. from the mines are preparing to ship at least a part of their fuel by motor trucks if the increase sought is granted.

The following letter from R. N. Collyer, chairman of the Railroads' Traffic Executive Assn., to W. H. Chandler, chairman of the National Industrial Traffic League committee, to coöperate with the railroad traffic executives, explains the present moratorium in rate changes pending the disposition of the application for a 15-per cent. increase in all freight rates. See also (PIT AND QUARRY, July 29, 1931.)

"Based on recommendations of the traffic executives, the President's Special Committee, representing Eastern, Southern and Western carriers, at a conference on July 13, modified the instructions of June 24 relative to rate changes in the period referred to, and I am now writing to explain the situation for the information of League members.

"The traffic officers are instructed, pending the result of hearings assigned by the commission in Ex Parte 103, to make no reductions or increases in freight rates except as follows:

"1. Changes in freight rates required by orders of the Interstate Commerce Commission or state commissions.

"2. Changes which, following consideration by the traffic committee having jurisdiction, had been covered by public announcement issued on or before June 24, 1931.

"3. Changes which had been recommended on or before June 24, 1931, by the traffic committee having initial jurisdiction and as to which public announcement had been withheld awaiting concurrence of other interested traffic committees or for other reasons, such as completion of routing, fourth-section justification, etc.

"4. Changes required by conditions of emergency, under arrangements for special consideration to be effected under the direction of the traffic executives in the respective territories.

"Paragraphs 2 and 3 of the foregoing clear the way for disposition of rate changes that had been acted upon on or before June 24.

"Paragraph 4 provides for emergency conditions and authorizes the traffic executives in the respective territories currently to effect important rate changes which the emergency justifies.

"In addition to the foregoing, provision was made for the submittal and committee consideration of rate proposals which an individual carrier deems to be of sufficient importance to warrant signature by its chief traffic officer. Rate publication based on a such proposal is to be withheld during the pendency of Ex Parte 103, but, if an emergency necessitates immediate action, this may be obtained as provided in paragraph 4.

"It is believed that these changes will make it possible to handle the more important rate changes with reasonable dispatch. The carriers realize that this moratorium in rate changes does not rest upon an agreement with the National Industrial Traffic League. The discontinuance of rate reductions, except in emergent situations, is deemed necessary because of the petition for increased revenue in Ex Parte 103. When advice of the discontinuance of rate reductions was given to representatives of the League at Chicago on June 25, the latter suggested discontinuance of increases in individual rates during the same period and this was accepted by the carriers."

Alabama Firm's Business Way Ahead of Last Year

Business of the Alabama Asphaltic Limestone Co. during the first six months of this year was greater than that for the entire year of 1930.

The Alabama Asphaltic Limestone Co. with general offices at Birmingham and plant at Margerum, Ala., was organized in January as the successor of the Alabama Rock Asphalt Co. The same officers, continued in the new company, include Wallace R. Caldwell, president, and E. F. Jung, secretary. T. E. Neill is superintendent of the plant at Margerum, which produces rock asphalt and crushed stone.

To Market Sulphur from Lower California Tract

The Sulphur Co. of Lower California, Inc., has acquired about 1,000 acres of rich deposits of sulphur located about 150 miles south of the international border and about three miles from the Pacific Coast. According to Antonio Muria Martinez, president and general manager of the company, development of the mineral will proceed shortly, shipments to be made by water to Los Angeles, San Francisco and other west-coast markets.

The company's United States offices are located at 1051 Myrtle Way, San Diego, Cal.

Starts Operating at New Brunswick Gravel Plant

Operations have begun at the new plant of the Fundy Sand & Gravel Co., Ltd., located at Fort Dufferin, New Brunswick.

G. Stephen Whitehead, is manager of the new company. G. G. Murdoch is president, Luther Smith, vice-president, and L. McC. Ritchie, secretary.

Geological Survey in Ohio Is Abandoned

APPROPRIATION BILL VETOED

Through the veto of Gov. George White of Ohio, the entire 1932 appropriation of the Geological Survey (only $15,500) was eliminated, thereby junking the organization and all its activities, an organization which has given continuous service for more than sixty years.

The work carried on by the Ohio survey has been largely economic in nature and has been a help to all those industries which are based on the mineral resources. Investigations have been made on the stratigraphic relations of the rock formations, on the extent of various deposits, on the nature and composition of the raw materials and on their fitness for useful products. These studies have included limestone, sandstone, conglomerates, gypsum, marl, peat, salt, brine, iron ore, coal, clay, shale, oil and gas.

Through consultation and correspondence the survey has been able to give advice to the industries which appeal to them for scientific help on their specific problems, and it has accumulated a mass of information, much of it unpublished, which is available to all who are interested.

Ohio's mineral resources are normally valued at more that $200,000,000 annually, which valuation gives the state sixth rank in the United States.

Metaline Falls Cement Plant to Keep Operating

The Lehigh Portland Cement Co. expects to operate its Metaline Falls, Wash., plant throughout the entire summer instead of closing down part of the time because of slack demand, according to announcements from Spokane, where the company maintains an office. The plant employs about 50 men and has a daily capacity of 1,000 bbl.

W. G. Perrow is manager and H. H. Helwig, superintendent, of the quarry and plant at Metaline Falls.

Opens New Gravel Plant 30 Miles from Wichita

The Independent Sand-Gravel Co., with headquarters in Wichita, Kas., has opened a new sand-and-gravel plant, located near the Santa Fe Railroad right-of-way near Douglas, Kas., about thirty miles east of Wichita. The capacity of this plant is about ten cars per day, and the deposit is of hard flint-gravel. W. E. Seright, who has operated sand plants in that vicinity for the past 15 years, and E. R. Funk are interested in the company. Most of the output will be used in state and federal-aid road building.

Explains Position in Cement Price War

UNETHICAL PRACTICES FLAYED

In an attempt to inform the public of its attitude toward price-cutting in the cement industry, the Lehigh Portland Cement Co. of Allentown, Pa., and Chicago, has just issued the following statement, which it has labeled an "Announcement to Lehigh Customers on Present Marketing Conditions in the Cement Industry":

"For some months past marketing conditions in the cement industry have been in a state of confusion. Many customers have asked us for an explanation of the situation. Because we have taken a leading part in an effort to stabilize marketing conditions in the industry, we should like to take this opportunity to make a definite statement of our position.

"The cement industry is not engaged in a price war or in cut-throat competition. Present marketing conditions are not the result of personal animosity between individuals in the industry. There has been no effort on the part of any manufacturer to drive a competitor out of business. On the other hand, there has been a determined effort on the part of certain manufacturers to stabilize an industry, so that that industry may survive and enjoy such measure of prosperity as its service to the public merits.

"The immediate effects of abnormally-low prices of any staple commodity are unquestionably harmful to both buyer and seller. Any industry, however, to be healthy and prosperous, must have stability before it can realize fair prices. In the cement industry, during the past few years, stability has been sadly lacking.

"Certain manufacturers have definitely committed themselves to a one-price policy and have struggled to maintain sound marketing methods. Other manufacturers, by quoting special prices and offering secret concessions, have taken away a large amount of the tonnage once enjoyed by those manufacturers who quoted prices openly and fairly. Toward the close of last year these practices became intolerable.

"The cement manufacturer committed to a one-price policy has been confronted with two alternatives: either he must adopt the practices of his competitors or he must take a stand for stability by quoting openly prices made secretly by his competitors. Since January 1, 1913, our company has been committed to a one-price policy. At no time, regardless of competition, have we sold a barrel of cement at less than our published prices and terms. To depart from this policy would, in our judgment, completely destroy orderly marketing in our industry.

"Last fall, compelled to choose between guerilla warfare and orderly marketing, we elected to continue to quote open prices at published terms. In conformity with this program, when lower competitive quotations have seriously jeopardized our business in a particular market, our prices have been reduced not only to those buyers who have received special quotations, but to all buyers alike in that locality. In no case have we attempted to take business from a competitor by price concessions, special extensions of credit, secret rebates, or any of the many other unethical practices that have crept into cement marketing. Rather than resort to such practices, we have preferred to quote openly to all buyers the prices we have found quoted secretly by competitors.

"Fortunately our company is not the only one that believes that sound marketing is vital to the future of the cement industry. Certain manufacturers, by their firm adherence to ethical principles, have contributed greatly to the movement for stability. Other manufacturers, with equal sincerity, have attempted to gain the same end by slightly different methods. We keenly appreciate the support, confidence, and understanding accorded us during these trying months by our customers and friends. To them we pledge our efforts to continue to strive for sound principles and constructive methods, which alone can reëstablish healthy marketing conditions in the cement industry.

"LEHIGH PORTLAND CEMENT CO."

Texas Awards Contracts for 594 Miles of Road

In addition to an unprecedented amount of highway construction now in progress in Texas, the State Highway Commission has awarded new contracts totalling $4,993,982 and involving the construction of 594 miles of highway and 36 bridges.

This work will be under way shortly and will give employment to a large number of men.

New Company in Empire State Builds Sand Plant

The Altamar Sand & Gravel Corp. of Syracuse and Fulton, N. Y., recently organized, is erecting a plant for processing sand at Altamar, N. Y., where a 100-acre deposit has been acquired. Work of installing machinery and opening up of the pit is in progress and shipments are expected to be made shortly. A spur track from the New York Central Railroad has been laid.

Gets Contract for 900 Tons of Highway Stone

The Southern Limestone Products, Cordele, Ga., has received a contract from the Georgia Highway Department for 900 carloads of limestone base material.

Tests Fail to Reveal Best Aggregate Type

DEPENDS ON SEVERAL FACTORS

An investigation conducted by the United States Bureau of Standards in an effort to determine which materials going into the manufacture of concrete are most resistant to disintegration, has been completed with the announcement that it does not seem possible to predict the treatment that will cause disintegration most rapidly for any type of material.

The question of durability in concrete has always been one of the most perplexing in this branch of construction. Examination of a large number of specimens indicated to the bureau that the aggregate itself was the cause of the breaking down and, because of this belief, the investigation was begun.

As a starting point, 36 samples, each of a variety of aggregates, including crushed rock, gravel and slag, were gathered from various sections, each sample approximating 500 lb. in weight. The aggregates collected were of the types most commonly used in making concrete. From each of these samples, a 40-lb. portion was selected and subjected to 150 cycles of each of the following treatments:

1. The freezing-and-thawing test, which in part reproduces the destructive action of nature.
2. The sodium-chloride treatment, which consists in soaking the specimens in a solution of salt and then drying them.
3. The sodium-sulphate test, carried out along the same lines as that with the sodium chloride, but with the substitution of sodium sulphate.
4. The boiling-and-drying test.

Before and after the tests the aggregates were weighed and physical conditions noted, after which they were incorporated in concrete cubes for compression-strength testing.

Generally speaking, granite and trap-rock showed less effect than other materials. However, one granite disintegrated noticeably during the chloride treatment whereas others were not affected. The same condition was found in the testing of limestone with sulphate, making it impossible for the Bureau of Standards to say with finality what are the most durable of the aggregates under different conditions tending to disintegrate.

100 Men Resume Work at Bessemer Cement Plant

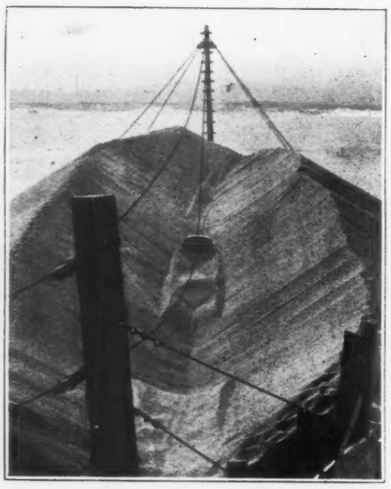
After two months of idleness, 100 men have returned to work at the Bessemer Limestone & Cement Company plant at Bessemer, Pa. Further recalling of employees is said to be likely soon if demand for the company's products is maintained.

Drag-Scraper Piles, Reclaims Pea Gravel

450-FT. SPAN BETWEEN MASTS

Out of a total daily production of 2,300 tons of sand and gravel at the plant of the Hahn Brothers Sand & Gravel Co., Muscatine, Iowa, 300 tons consist of pea gravel (⅛ to ⅜ in. in size), for which there is a widely fluctuating demand. Production often runs ahead of demand, while at other times it can be sold in quantities greater than the day-to-day output. This material, accordingly, is maintained in reserve storage in a stock-pile served by a ½-cu.yd. Sauerman power drag-scraper.

The small gravel is chuted from the screening plant (when not needed to fill immediate orders) to a pile in front of the headpost of the drag-scraper system, and from that point the

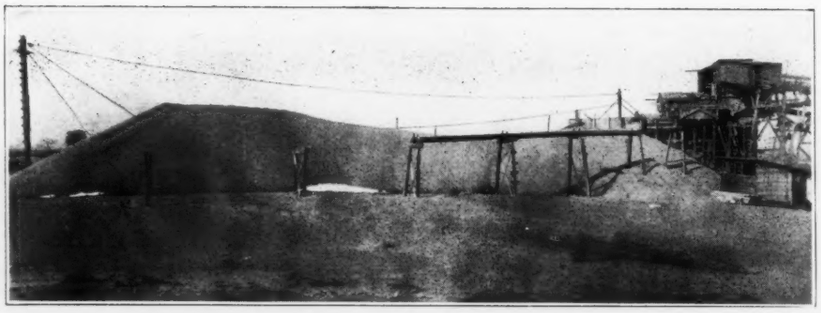


Scraper reclaiming from stock-pile.

scraper drags it out toward the high mast at the outer edge of the yard, building the material into a long, high pile. Later the same scraper is simply turned around, when additional pea gravel is needed to balance production and demand, to drag the material back to a small portable belt-conveyor which loads it into railroad cars. To reach any of the outer edges of the pile, the scraper operates from a tail-block placed anywhere along a bridle cable slung between the mast and a ground anchor on the respective side of the storage pile.

The scraper's overall span between the headpost and the mast is about 450 ft., and its hourly capacity, at an average haul and when in full operation, is about 75 cu.yd. The amount put into or taken out of storage in a month's time varies widely, of course, because of the fluctuating conditions of the demand.

The Hahn Brothers plant also has a daily output, when in full operation, of 500 tons of ¼-in. to 1½-in. gravel and 1,500 tons of sand. The Hahn brothers are Harry E. and Walter E. Hahn.



The total span between masts is 450 ft.

Concrete-Pipe Plant to Furnish 6,500-Ton Order

The Alabama Concrete Pipe Co., Birmingham, Ala., has secured an order for 6,500 tons of concrete pipe to be shipped to Tuscaloosa. The pipe will range in size from eight inches to thirty inches. Full operations were resumed at the plant of the Alabama Pipe Co. on July 27, after operations had been on a one to two-day weekly basis for some time past.

The Tuscaloosa order, together with several others, provides at this time sufficient tonnage to insure steady operations until the end of the year.

Nevada Operators Make First Feldspar Shipment

Three 60-ton carloads of feldspar were recently shipped from the property of Nate Kearns & Sons, located 18 miles north of Reno, Nev. The property is 10 miles from the railroad. Shipments are consigned to the American Development Co., at Berkeley, Cal., which is paying $10.25 per ton for feldspar, f.o.b. Berkeley. Railroad freight from Reno to Berkeley is $2.30 per ton, leaving $7.95 to cover mining and trucking charges.

At present, ore is extracted entirely by surface quarrying from a deposit 1,500 ft. long and 4 to 18 ft. wide. It has been explored to a depth of only 15 ft. In addition to feldspar, analyses of the material made by the Mackay School of Mines have indicated the presence in the deposit of rare metallic ores.

So far as can be determined, this is the first commercial exploitation of a feldspar deposit in Nevada.

New Officers Named by Pacific Coast Producer

Since the first of the year, Pacific Coast Aggregates, Inc., one of the largest producers of sand and gravel in the country, has made numerous changes in its list of officers and personnel. This company operates 24 producing plants in the vicinity of San Francisco as well as numerous distributing plants in San Francisco, Oakland, Sacramento and other nearby cities and towns.

Charles M. Cadman has succeeded N. B. Livermore as president. Mr. Cadman is also president of the U. S. Line Products Corp. F. W. Erlin, vice-president and general manager; C. A. Roller, secretary and treasurer; and A. D. Hadsel, operating manager, resigned some time ago. Recently appointed are: E. B. Kendall, operating manager; Howard Senter, secretary and treasurer; and Don Meek, sales manager.

Since August 1 this company has become purely a producer of gravel. All distribution of materials in San Francisco is now being handled by the Golden Gate-Atlas Co. and in Oakland and Sacramento by Transit Concrete, Ltd., both subsidiaries of the parent company.

Simplify Standards for Industrial Wire Screen

The division of simplified practice of the National Bureau of Standards has just announced that a general conference of all interests held in New York, N. Y., on June 18, 1931, approved a simplified-practice recommendation covering wire screen-cloth. The appointment of a standing committee of the industry was also authorized by the conference. This simplification program considers the mesh-wire size, width and length of roll, and method of packing steel-wire screen-cloth, and bronze- and copper-wire screen-cloth. The recommendation will be effective one month from the department's letter announcing the receipt of the required degree of acceptance.

Close Montana Plant of Three Forks Cement Co.

R. J. Morse, vice-president and general manager of the Three Forks Portland Cement Co., with headquarters at Denver, Colo., was at the company's plant at Hanover, Mont., recently assisting Superintendent J. C. Capper in checking over the cement plant preparatory to closing down for the season. Only the cement plant is being closed down and that according to the usual seasonal plan except that the shutdown comes about a month early this year, owing to the fact that large stocks are on hand.

The plaster mill and gypsum mines will continue as usual with their regular force of from 30 to 40 employees, it is reported.

Mr. Schneider's prize-winning rock-garden display.

Cement Testing Reaches Peak Year of Activity

Cement sampling and testing in the United States Bureau of Standards reached a new high mark in the fiscal year just ended, a total of 2,311,000 bbl. having been tested in the twelve months period.

The laboratories of the bureau at Washington as well as sub-stations in Northampton, Pa., Denver, Colo., and San Francisco, Cal., experienced their busiest year answering the calls of other bureaus concerned in the national public-building program as well as furnishing service to others in instances where commercial laboratories are not equipped to fill the requirements.

This year's cement samplings exceeded those of the 12-mo. period which preceded by 42 per cent.

The unprecedented rush of business is attributed by Dr. George K. Burgess, director, to the fact that industries are taking advantage of the present general lull in activity to catch up on research work.

Carolina Concern Will Make Asbestos Awnings

A new company which will manufacture fireproof awnings—the Awnbest Corp.—has taken the plant formerly operated by the General Asbestos & Rubber Co. at Charleston, S. C.

The new company expects to start operation about September 1. It will use a new asbestos fabric produced by Raybestos-Manhattan, Inc., with W. H. Donnelley in charge of production and E. W. Coyle in charge of sales.

Engineering Awards in July Exceed Last Year's

In July, for the first time this year, engineering construction contracts awarded throughout the country exceeded the total for the corresponding month last year. Lettings in the five weeks aggregated $270,110,000, which compares with $196,326,000 in the four weeks of June and $263,557,000 in July, 1930, a five-week month. The cumulative value of awards for the seven months in 1931, however, has reached $1,664,257,000, while $2,114,380,000 is the total for the same period last year, a drop of 22 per cent.

Geographically the gain was made in the Middle Atlantic states, in the region between the Mississippi River and the Rocky Mountains and in the Far West. Significantly, this half of the country, except the Far West, recorded strong gains in private contract letting.

Armour Gets Control of Phosphate-Rock Property

The Armour Fertilizer Works, operators of the Armour phosphate mines near Columbia, Tenn., have secured the perpetual mining lease of the Ridley Phosphate Co. for the phosphate deposits in that area, and have begun shipments of rock from this property, according to J. A. Chapman, local manager of the Armour concern.

Mr. Chapman also announced that beginning August 1 some of the departments of the main plan at Armour mines, temporarily closed down, began operations in full, which means the adding of a number of workers to the payroll.

Crushed-Stone and Lime Producers Consolidate

The Mercer Lime & Stone Co. of Branchton, Pa., has acquired the Chimax Lime & Stone Co., operating a plant at Wick, Pa.

Both plants produce crushed-stone and lime. S. S. Smith heads the concern.

Rock Gardens Create Market for Producer

DISPLAYS ATTRACT VISITORS

In addition to operating a sand-and-gravel plant for the commercial production of aggregates, Wm. R. Schneider of Elgin, Ill., does an extensive business in supplying rock for rock gardens which have achieved a high degree of popularity in recent years with home owners, gardeners and landscape architects.

The accompanying picture shows Mr. Schneider's exhibit at the recent Illinois Flower and Garden Show held at the Merchandise Mart, Chicago, which was awarded a special blue ribbon for the excellence of display and ingenuity of arrangement. The rock used was a porous limestone obtained in Iowa and Wisconsin, with colored granite obtained in Mr. Schneider's locality and Kentucky cavern crystal supplying the color and embellishment.

As many as 1,500 persons have visited Mr. Schneider's rock gardens and rock display in one day. Visitors are urged to sign a register which discloses that people from 19 states have stopped and admired the Schneider display or purchased rock for their own gardens this year. The displays are lighted at night and attract much attention from passing motorists.

In addition to selling a large variety of garden rock, Mr. Schneider deals in such accessories as rock and water plants, flagstones for walks, and even goldfish! "Rustic rock—one rock or a carload" is his slogan.

Concrete-Road Building Continues at High Level

Concrete highway, street and alley construction for the period January 1 to July 18, last, totaled 100,135,089 sq.yd. as compared with 91,464,834 sq.yd. in the like period a year ago, according to the Portland Cement Assn. Although street and alley construction was lower by approximately 7,500,000 sq.yd. this year, the decrease was more than offset by the gain of about 15,000,000 sq.yd. in highway building.

The chief stimulus for an increase in concrete road building this year is the $80,000,000 federal fund which is available to the states for highway building in addition to the regular federal aid for road construction. This money, which is an advance from future federal aid, was made available primarily to relieve unemployment and must be paid back out of future appropriations between 1933 and 1937. A further stipulation was that the money be spent for highway construction work which will be completed before September 1, this year.

Editorials

A Tax on Progress

INDUSTRIAL development, in so far as it is dependent on technical knowledge, may be expected to proceed more slowly and at greater expense in Canada than in the United States, for, in deciding to place a tax on American magazines—technical and industrial as well as general and fiction—the Canadian government is making it difficult for Canadian business men to keep step with progress. This form of retaliation—for that is what it seems to be—displays more pique than good sense, because in most fields of industry Canada does not publish first-class trade or technical journals for the obvious reason that they can not exist on the low advertising rates warranted by small circulation.

In a few cases American publishers may decide to pay the tax themselves, but generally it will be added to the Canadian subscription prices, and Canada will be placed in a class with countries at the opposite side of the world. In either case the law will have the effect of checking the spread of technical and industrial knowledge in Canada and, in our opinion, no people has yet reached the point where it can afford to deny itself the fruits of other people's knowledge. If the Canadian people realize what this means and if they are satisfied with the result, it certainly is not within our province to complain. If the Canadian business man believes that he has passed beyond the point where knowledge of technical and industrial advance in the United States can be of any use to him, we shall content ourselves with saying that we believe he has embraced an erroneous idea that is not justified by the facts and that will not work for his best interests.

From our point of view we see no reason why Canadians should pay a higher price for technical knowledge of the kind furnished by the American trade and technical press than Americans, since no more formidable barrier than a political boundary separates the two peoples. Yet we feel certain that the financial burden imposed by the tax will be paid by Canadians and not by American publishers. Canadian readers form but a small part of the circulation of American journals and their value to American manufacturers—and, so, to American publishers—may be considered directly proportional. Their loss will impose no greater hardship on American advertisers than the ordinary year-to-year fluctuations in the number of American subscribers.

To continue to serve Canadian readers at the same subscription price as that at which they serve Americans would be in effect to cut the price of technical knowledge in favor of Canadians and to the disadvantage of Americans. Canadian lawmakers may delude themselves into thinking that American publishers will adopt such a policy, but we are sure that no large body of Canadian business men hold any such fallacy. If the Canadian government insists on making it difficult and expensive for Canadians to keep informed regarding American industrial and technical developments, Canadians must be prepared to pay the price and suffer the hardship, unless they wish to have the law repealed and so reëstablish themselves among the group of nations which for so many years have freely and advantageously exchanged their ideas.

What About Geology?

IT is to be expected that the craze for economizing should result in the establishment of ridiculous standards of value, that many worth-while activities should be curtailed or discontinued while more spectacular forms continue without restriction, and we are always prepared for evidence of such shortsightedness in political circles. But recent news from Ohio and Tennessee indicates that the record of past follies is likely to be exceeded by the newest examples of economy in government and that large industrial groups are to be denied, at least temporarily, the benefits of government-conducted scientific work.

The Ohio Geological Survey, which has rendered such conspicuously useful service to the nonmetallic-mineral industries of its state, has been discontinued by the authority, we undertand, of the State Board of Control. In spite of the fact that an appropriation of only $15,000 is needed to keep the survey alive and functioning, mineral producers of the state are to be deprived of the only arm of state government which is likely ever to be of great use to them. This example of governmental stupidity is rivalled but not matched by the action of Tennessee where, it is reported, the state's geological activities, accustomed to an appropriation of $39,000 for operating expenses, will be forced to continue on the insignificant sum of $500. This probably comes as near to extinguishing the spirit of Tennessee's geological workers as anything we can imagine.

It is almost inconceivable that any form of government work, so useful to large sections of industry, could be so easily discarded. We do not have access to the budget figures with which Ohio and Tennessee officials have been forced to struggle and we probably do not understand the difficulties of trying to satisfy the public clamor for economy and at the same time to hold huge political organizations intact, but we do not hesitate to guess that the funds for geological work could easily have been found by trimming the large expenses of some other departments, which, while they may be much more useful politically, are not nearly as valuable industrially.

The nonmetallic-mineral industries of this country owe a great deal to the state government work-

ers who have studied and platted the nonmetallic-mineral resources on which those industries are founded. We understand that a great many men have a profound contempt for scientific knowledge as well as for other things they do not understand and, therefore, do not properly appraise, but we doubt whether it would be possible to gather any considerable group of intelligent and successful mineral producers who would not readily admit that government geological activities have not been worth much more than they have cost. The dependence of our industries on geological knowledge —in the future as well as in the past—is too great and too well known among those who are qualified to place a value on it to have it lightly dismissed by sweeping and ruthless economy measures which undo in a few hours the accumulated work of many years. Interested producers who have not already protested should write immediately to their governors or budget-fixing departments, pointing out the industrial importance of geological work and urging a reconsideration of government expenditure with the view of conserving one of the most useful forms of government activity, even at the expense, if necessary, of other forms of less certain utility.

The Freight-Rate Increase

IF other industries were able and willing to present to the Interstate Commerce Commission as cogent reasons for not raising our freight rates as those offered by sand-and-gravel producers, we believe that the railroads' plea for a 15-per cent. increase would have small chance of success. Elsewhere in this issue is published an abridged report of the arguments laid before the commission by Mr. Ahearn, executive secretary of the National Sand & Gravel Assn., yet even this necessarily short review gives ample evidence of the skill with which the material was collected, prepared and presented. It is an example of effective trade-organization work well conceived and well executed and displays how whole-heartedly producers can coöperate when the spirit moves them.

Mr. Ahearn's argument shows by means of data, as well as by the confirmatory opinions of producers in all parts of the country, what is likely to be the effect on the shipment of sand and gravel of any freight-rate increase applied to those products. He shows that, in spite of large increases in the production of sand and gravel, the amount of these products shipped by railroad has not shown similar increases, even under the existing rate structure, and states the inescapable conclusion that any increase in freight rates must have the inevitable result of diverting still more sand-and-gravel tonnage to motor trucks and other carriers.

Spokesmen for the railroads have let it be known that the roads would not apply the proposed increase, if granted, to hauls within the range of motor-truck transportation, disclosing, incidentally, the railroads' age-old adherence to the theory of charging all the traffic will bear. They overlook, however, the fact that sand and gravel are products of common and widespread occurrence and that a haul which may seem to be beyond the range of economical motor-truck delivery—and so, by their reasoning, exclusively within the sphere of costly railroad transportation—is likely to be within the range of truck transport from some wayside pit, which relies solely on motor trucks and contributes nothing to railroad revenue. The wayside pit has offered severe and destructive competition to established sand-and-gravel producers even under existing conditions and, as Mr. Ahearn points out, this competition may be expected to increase if the differential between railroad and motor-truck costs is made larger. Any injury done to establish producers, whose product is shipped by railroad, must affect adversely the freight revenue of the railroads now serving them. It is doubtful whether a 15-per cent. increase in the rates on sand and gravel would not be more than offset by the loss of that tonnage diverted to competing roadside pits which ship by truck.

Mr. Ahearn made a well-reasoned, and we hope an effective, plea for the shippers he represented. We deem it unfortunate, however, that nonmetallic-mineral producers did not act as a class, instead of leaving the burden of the investigation and presentation on the shoulders of a single branch of the industry. Whatever advantages may accrue from the action taken by the sand-and-gravel association will benefit all nonmetallic-mineral producers in much the same way, yet, for the most part, these potential beneficiaries have not been willing to give their support to the plea that was made. In remaining aloof they have not only done nothing to help themselves but they have weakened the plea of those who made it by withholding strength that was badly needed.

The proposed freight-rate increase affords a striking example of the ways in which a single trade organization, embracing all branches of the nonmetallic-minerals industries, could have done an immeasurably greater service than any fractional part of those industries working alone. As these industries are now organized, they are not in a position to present a united front to any formidable opposition. Capitalizing what they consider a difference, and even a rivalry, of interests, they proceed along independent lines and so work at cross purposes, each, in seeking to advance its own interests, obstructing to just that degree the greater interests of all.

The unwillingness of certain trade organizations within the nonmetallic-mineral industries to join the National Sand & Gravel Assn. in making common cause of the freight-rate problem has been the subject of much disapproving comment among members of the associations involved and among some who were not consulted but who heard of the proposals and their rejection. There is a rapidly growing conviction among trade-association members that a single organization, representing all branches of the industries which have so much in common and so much to gain through concerted action, can render a far broader and more useful service to those industries than the numerous separate organizations which, in the very nature of things, thrive largely on inter-industrial problems and ignore those large issues which affect all alike.

The accompanying photograph "Sand Island Activities" was awarded the Joseph T. Ryerson prize in the industrial-picture class at the recent Third Chicago International Photographic Salon. It is the creation of Elaine H. Kern, a Chicago woman whose hobby is photography. Mrs. Kern has received many awards in various photographic salons throughout the world. "Sand Island Activities" was one of about 1,700 photographs submitted to the International Salon, many of which are on exhibit at the Chicago Art Institute.

The Nonmetallic Mineral Resources of MICHIGAN

By O. F. POINDEXTER
Geologist, Michigan
Geological Survey

OWING to the wide range of geologic history represented in its time scale, with a corresponding variety of rock types, Michigan possesses a diversity of nonmetallic-mineral deposits, many of which are extensively exposed at the surface, possess a high degree of purity, and are favorably located for their recovery, treatment, and transportation to large consuming centers; hence are of considerable economic importance.

Nonmetallic-mineral deposits in Michigan range in age from sand and gravel, marl, peat, and clay of the Pleistocene and Recent to trap rock, marble, quartzite, feldspar, graphite, slate, etc., of Algonkian and Archean age. With the exception of sand and gravel, the most valuable nonmetallic-mineral deposits at the present time are found in rocks of Paleozoic age.

In 1929 mineral production in Michigan amounted to $146,800,000, of which $66,400,000, or about 45 per cent., represents the value of the nonmetallic production. Stone, sand and gravel, cement, gypsum, and salt accounted for $48,150,000, or about 73 per cent. of the total nonmetallic production. For many years salt held first rank as Michigan's most valuable nonmetallic-mineral product. In 1929, however, the value of stone was slightly greater than that of salt. A total of 13,682,659 tons of stone was quarried and Michigan ranked third among the states in this respect. The state was sixth in value, however, owing to the use of the bulk of the material in the manufacture of pig iron, Portland cement, and chemicals.

Limestone

With the exception of small amounts of trap rock and sandstone, stone produced in Michigan at the present time is all classified as limestone. Limestone of varying degrees of purity and dolomite occur at all geologic horizons from the Coal Measures to the Pre-Cambrian. There are impure beds of limited extent and depth occurring in the Coal Measures, Marshall, and Coldwater formations. These beds are, however, of no commercial importance.

Bayport Formation.—Beds of variable character with limited possibilities for development occur in the Bayport and Michigan formations of the Grand Rapids series. The stone varies from a pure limestone, averaging 95 per cent. calcium carbonate, to normal dolomite and is locally sandy and cherty. The Bayport formation is not a continuous bed, having been largely removed by post-depositional erosion. The chief exposures are near Bellevue, Eaton County, where a high-calcium bed 12 to 15 ft. thick is utilized for the manufacture of Portland cement, and near Bayport, Huron County, where it is quarried chiefly for crushed stone for road material and concrete aggregate. In addition to these occurrences the only other known exposures of the Bayport on a commercial scale are in the vicinity of Omer in Arenac County. The limestone resources of Arenac and Huron Counties, while not large, occupy somewhat strategic positions, owing to their proximity to water transportation and to the scarcity of gravel for road construction in the region surrounding Saginaw Bay which is largely old clayey and sandy lake beds formed when the Great Lakes stood at higher levels.

Traverse Formation.—The most important resources of high-calcium limestone in the state are to be found in the Traverse and Dundee formations of the Middle Devonian period. The Traverse formation underlies most of the Lower Peninsula and outcrops in a broad belt in the north-

Map of Michigan showing stone and gypsum deposits under shallow cover; also active mines, quarries, cement mills, lime kilns, sand-lime brick plants, and the chief producing centers for sand and gravel. The stone areas as shown are more or less diagrammatic. In order to show stone occurring at certain localities it is necessary to use symbols considerably out of proportion to the actual area of stone exposed. No attempt has been made to show configuration of these smaller areas.

ern part of the peninsula extending from Thunder Bay on Lake Huron to Little Traverse Bay on Lake Michigan. The chief developments in the Traverse formation at the present time are at Alpena and Rockport, Alpena County; Afton, Cheboygan County; and Petoskey, Emmet County. The stone is used chiefly for alkali, Portland cement, blast-furnace flux, lime burning, road metal, and concrete aggregate.

The stone varies in composition from high-calcium to high-magnesian limestone and normal dolomite. Some portions are also shaly and cherty. In the Alpena district some of the coral reefs occurring in the Alpena limestone have become heavily dolomitized and are known as "chimneys." Generally, however, the reef limestone is free from magnesia and other impurities. The thickness of the Traverse formation in the northern part of the state ranges from 600 to over 700 ft. It has been quarried in Alpena to a depth of about 125 ft.

The Traverse also forms a less extensive belt in the southeastern corner of the state. It is, however, under a rather heavy drift cover; hence is of no economic importance in that region.

Dundee Formation.—The Dundee is the next-lower formation below the Traverse and, like the latter, underlies almost the entire Lower Peninsula. The exposed areas are, however, considerably less extensive than those of the Traverse formation. They constitute a narrow belt in the southeastern part of the state and come to the surface again along the Lake Huron shore from Presque Isle County to Mackinaw City, Cheboygan County. The only developments are at Rogers City, Presque Isle County, and at Sibley, near Detroit. The Michigan Limestone & Chemical Co. at Rogers City is reputed to be the largest producer of limestone in the world. The principal uses to which the stone is put are as follows: flux, alkali, Portland cement, road metal, calcium carbide, concrete aggregate, and lime.

The Dundee stone is generally a very pure limestone, some of the beds averaging over 98 per cent. calcium carbonate. Locally, however, it is dolomitic near the base of the formation where it is in contact with the underlying dolomites of the Monroe Formation. The average thickness is about 100 ft. in the Detroit area and over 200 ft. in the northern part of the Southern Peninsula. At Rogers City it is quarried on two levels, each having a working face of about 40 ft.

Most of the more important deposits of Traverse and Dundee limestone convenient to water transportation have been developed or acquired by present operating companies. Undeveloped deposits near water transportation occur north and northeast of Alpena, southeast of Rogers City, near Mackinaw City, Cheboygan County, and near Charlevoix and Norwood, Charlevoix County.

There are enormous inland reserves of high-grade limestone in Alpena and Presque Isle counties, and near Afton, Cheboygan County. The reserves of limestone of the Little Traverse, Thunder Bay region, located near the lake shores, are sufficiently large to supply stone at the present rate of production for a great many years; hence the large inland deposits may be thought of in the light of practically inexhaustible reserves.

The Dundee limestone is exposed at a number of localities near Dundee, Monroe County, in the southeastern part of the state, and several small quarries have been operated in the past. The stone is of good quality but the reserves are not comparable to those of Dundee limestone in the northern part of the state. There are no large reserves of stone in the vicinity of the Sibley Quarry in Wayne County. The deposit in which the quarry is located represents simply an isolated knoll, there being no other outcrop of Dundee limestone in the county.

Monroe Formation.—The Dundee Formation is underlain by the Monroe Formation which outcrops in the southeastern part of the state just west of Lake Erie and again at the Straits of Mackinac. With the exception of the Sylvania sandstone member and a local bed of high-calcium limestone, the Monroe Formation is normally dolomitic and more or less argillaceous and siliceous, with considerable sulphur and other impurities present. These qualities render it unfit for lime burning and chemical purposes, although in early days it was much used for the former of these. Most of the stone is, however, well suited for road metal, concrete aggregate, and railroad ballast, for which purposes the bulk of the production is now used. The Monroe beds are exposed at a number of localities in Monroe County and a quarry is in operation near Monroe.

There do not appear to be any suitable localities for the opening of quarries in the exposures of the Monroe Formation in the northern part of the state. Some lime has been burned in the vicinity of St. Ignace and other places, but, due to the exhaustion of cheap fuel and to the impure and brecciated character of the stone, the quarries and kilns were abandoned.

Salina Formation.—The Salina Formation of Middle Silurian Age, which underlies the Monroe, has been shown from well records and samples to consist of thick beds of dolomite and rock salt with local beds of limestone. The Salina Formation, has, however, not been identified in outcrop within the state; hence it is of no importance as regards reserves of stone. Some of the beds described as Monroe on the St. Ignace Peninsula may belong to the Salina.

TABLE I—SOME ANALYSES OF MICHIGAN LIMESTONES.

Formation	Location	$CaCO_3$	$MgCO_3$	SiO_2	Fe_2O_3	Al_2O_3
Bayport...	Bayport, Huron Co.....	91.54	0.944	3.33	.....	1.33
Bayport...	Bayport, Huron Co.....	61.52	14.50	20.85	.....	2.19
Bayport...	Omstead, Arenac Co.....	53.50	41.43	3.94	.....	1.14
Traverse...	Rockport, Alpena Co....	97.25	1.84	0.19	.....	0.77
Traverse...	Alpena, Alpena Co.....	94.02	3.16	1.69	.....	.98
Traverse...	Petoskey, Emmet Co.....	92.27	6.74	1.05	.....	.43
Traverse...	Afton, Cheboygan Co....	96.52	0.90	2.10	.....	.34
Dundee....	Calcite, Presque Isle Co..	97.85	1.26	.34	.....	.....
Dundee....	Sibley, Wayne Co.....	85.15	10.12	3.11	.....	1.40
Monroe....	Monroe, Monroe Co.....	52.21	43.08	.....	4.58	.....
Engadine..	Ozark, Mackinac Co.....	54.02	42.83	0.26	.....	0.11
Fiborn.....	Fiborn, Mackinac Co....	94.95	2.34	0.58	.....	0.46
Fiborn.....	Calspar, Schoolcraft Co... (old quarry)	97.50	1.00	1.40	.....	Trace
Fiborn.....	Hunt Spur, Schoolcraft Co.	96.82	3.64	1.20	.....	0.24
Trenton...	Groos, Delta Co.....	76.96	15.47	4.79	.....	2.63

Note.—These analyses are taken from Publication 21, Geological Series 17, Michigan Geological and Biological Survey.

TABLE II—RESULTS OF PHYSICAL TESTS ON SAMPLES OF MICHIGAN LIMESTONES.

Formation	Location	Specific Gravity	Absorption (*lb. per cu. ft.*)	Percentage of Wear (Standard Chamber)	French Coefficient of Wear	Hardness (Avg.)	Toughness (Avg.)	Cementing Value
1. Bayport	Bayport, Huron Co	2.64	1.09	3.6	11.2	16.00	11.3	36.5
2. Traverse	Petoskey, Emmet Co	2.63	.90	5.2	8.1	14.00	7.6	48.0
3. Monroe	Monroe, Monroe Co	2.53	4.17	5.0	8.6	12.9	6.6	17.4
4. Engadine	Marblehead, Schoolcraft Co	2.71	1.41	3.9	10.2	15.7	5.4	68.6
5. Fiborn	Calspar, Schoolcraft Co. (old quarry)	2.68	0.51	3.8	10.7	15.2	8.6	31.2
6. Manistique	Manistique Schoolcraft Co	2.72	1.78	3.8	11.1	15.9	10.55	28.5
7. Trenton	Groos, Delta Co	2.80	.68	3.4	11.6	16.5	12.09	Good

RESULTS OF TESTS ON STONE OTHER THAN LIMESTONE

Kind of Rock	Location	Specific Gravity	Absorption (*lb. per cu. ft.*)	Percentage of Wear (Standard Chamber)	French Coefficient of Wear	Hardness (Avg.)	Toughness (Avg.)	Cementing Value
8. Quartzite	Marquette Co	2.91	.....	5.7	7.0	19.2	16.8	.....
9. Granite	Marquette Co	2.67	0.02	2.2	18.2	19.1	17.0	74.5
10. Trap Rock	Marquette Co	2.92	.70	3.0	13.4	17.1	16.0	49.0

Note.—Nos. 1-6 incl.—Tests conducted by State Highway Laboratory, Ann Arbor, Mich., 1922. Values given are averages of all samples from each quarry.
Note.—No. 7.—Test conducted by Division of Tests, Bureau of Public Roads. Department of Agriculture, Washington, D. C., 1906.
Note.—Nos. 8, 9, 10.—Miscellaneous tests at State Highway Laboratory.

The discussion of the formations from the Bayport to the Monroe covers all the known reserves of limestone and dolomite in the Lower Peninsula. Beds older than the Monroe are found in outcrop only in the Northern Peninsula.

Niagaran Series.—The most important group of limestone and dolomite beds in the Northern Peninsula belong to the Niagaran Series of the Lower Silurian. The Niagaran is chiefly dolomitic in character but the lower part contains some very important beds of high-calcium limestone. It underlies a broad belt extending from the Garden Peninsula, Delta County, to Drummond Island, Chippewa County, and it is at or near the surface over large areas and under favorable quarrying conditions. The deposits are fairly convenient to water transportation in most instances, but good harbors are difficult to obtain, owing to the general lakeward dip of the strata, causing shallow water for long distances off shore.

Engadine Formation.—The upper member of the Niagaran Series, which borders the north shore of Lake Michigan from the vicinity of Seul Choix Point to Drummond Island, is provisionally known as the Engadine Formation from the exposures near the village of Engadine, Mackinac County. It is a bluish white to bluish gray and buff-gray massive, crystalline, generally very pure dolomite, suitable for basic linings in open-hearth furnaces and for sulphite-process paper manufacture. It is also excellent for road metal, concrete aggregate, railroad ballast, and riprap. Especial attention will be given to the production of riprap near Port Inland, Schoolcraft County by the Inland Lime & Stone Co. Very large non-shatterable blocks can be obtained. The Engadine dolomite has been quarried chiefly at Ozark, Mackinac County, and at Marblehead, Schoolcraft County, where it was used for burning lime. The reserves of high-grade dolomite embodied in this formation are unlimited.

Manistique Series.—The Manistique Series underlying the Engadine has been much used for the burning of lime, particularly in the vicinity of Manistique. The variable, dolomitic character of the beds, however, lessens the value of the stone for this type of use. It is well adapted, however, for use as road metal and concrete aggregate. The chief exposures are in the vicinity of Manistique the west side of the Garden Peninsula, near Gould City, Engadine, Trout Lake, Rockview, and Drummond Island.

Hendricks Series.—Below the Manistique Series lies the Hendricks Series which contains a very important bed of high-calcium limestone having an average thickness of perhaps 25 ft. to which the name "Fiborn" has been provisionally assigned. The outcrop forms a narrow belt extending from a point near the east line of Delta County possibly to Drummond Island. Exposures are fairly numerous and several are very extensive, indicating that a large reserve of pure limestone is available in this part of the state. The chief exposures are at Blaney, Hendricks, and Fiborn quarries, near Gould City, Hunt Spur, several miles north of Engadine, and Whitedale, and two or three miles northwest of Trout Lake. Quarries are operated in the Fiborn bed near Hunt Spur and Fiborn, Mackinac County, near Blaney, Schoolcraft County, and at Hendricks, Mackinac County, where the stone was quarried for use in the manufacture of calcium carbide. The present use of the product is chiefly for flux, and lime for paper manufacture and other chemical purposes. The Fiborn limestone is suitable for macadam roads, owing to its high cementing power, but is not so well adapted for use as concrete aggregate, owing to its being rather soft and brittle.

The remaining beds of the Hendricks Series which underlie the Fiborn bed are exposed in the floor of the Hendricks quarry and drill cores have been analyzed to a depth of 145 ft., showing the strata to be composed of alternating beds of high-calcium and low- to high-magnesian limestone. Since known exposures of the beds of the Hendricks Series below the Fiborn are few in number it is doubtful if these beds will become of any great commercial importance.

From the base of the Niagaran Series represented by the Engadine, Manistique, and Hendricks Formations to the next important limestone bed is a matter of about 500 ft. in vertical section. The intervening beds are largely shale, some of which are highly calcareous, and argillaceous to shaly lime-

stone of no importance from the standpoint of crushed stone but of possible suitability for the manufacture of Portland cement. The Cincinnatian Series of the Ordovician period comprises the bulk of these beds which are exposed in a prominent bluff on the west side of the Stonington Peninsula opposite the city of Escanaba.

Trenton Formation.—The Trenton Formation underlying the Cincinnatian Group, as represented by the outcrops in the Northern Peninsula, is composed of limestones and dolomites of variable character. It is generally argillaceous and locally bituminous in this part of the state. The Trenton occupies a broad belt extending from Menominee to St. Mary's River, near which it becomes much narrower. The chief exposures are in the vicinity of Menominee and Escanaba along the lower courses of the Ford, Escanaba, Rapid, and Whitefish Rivers. It is also exposed along the St. Mary's River. A quarry is in operation several miles northwest of Escanaba where the stone is produced for road metal and concrete aggregate, to which uses the material is best adapted.

Beekmantown Formation.—The Beekmantown (Calciferous, Lower Magnesian, Hermansville) Formation is the oldest of the Paleozoic limestones. It forms a belt bordering the Trenton to the north, northwest, and west. Outcrops, however, are not numerous, the principal exposures being in the bed of the Menominee River, at several places in Alger County, and on Neebish Island. The Beekmantown in northern Michigan consists of light-colored sandy dolomite, grading into white sandstone. The stone has a limited commercial application.

Other Formations.—Precambrian limestones are found at a number of places in the western half of the Upper Peninsula. Near Marquette the limestone formation is known as the Kona dolomite. In the Crystal Falls, Menominee, Sturgeon River, and Felch districts it is called the Randville dolomite; in the Iron River district the Saunders Formation; and in the Gogebic district it is referred to as the Bad River limestone. These formations are supposedly of the same geologic age. The stone is generally heavily magnesian to normal dolomite, and is more or less contaminated with cherty and argillaceous impurities and silicate minerals, which have resulted from metamorphic processes. In regions of more intense metamorphism the stone has become marbleized. Where metamorphic processes have been less active little or no alteration has occurred.

Quarries are located at Randville and Felch and the stone is used principally for Pebble dash, cast stone, and paint filler. It is not definitely known whether or not the stone would meet specifications for concrete aggregate. The admixture of diverse minerals and probable incipient fractures developed by metamorphic stresses may result in an unsatisfactory crushing-strength test. The presence of chert may also constitute an undesirable feature.

Sandstone

Sandstone occurs in Michigan at a number of horizons, namely the Saginaw and Parma Formations of the Coal Measures, the Marshall, Coldwater, Berea, Sylvania, St. Peter, and Lake Superior Formations, also possibly the Pre-Cambrian. The sandstones of the Coal Measures and Marshall Formations have been extensively quarried in the past at a number of places in the south central part of the Lower Peninsula for building stones. Competition with sandstone and limestone from Ohio and Indiana, however, forced discontinuance of these operations so that to-day there is but a single quarry operating for sandstone, the chief use of which is for the manufacture of grindstones. Sandstone can not compete with gravel for road material and concrete aggregate in the Lower Peninsula owing to the abundance and low cost of the latter. In certain areas in the Northern Peninsula where gravel is not so abundant sandstone is actively quarried for road material. There are many places along the Lake Superior shore where sandstone can be quarried and a number of places where a beautiful red building stone is obtainable. This material, known by a number of different trade names such as "Portage Redstone," "Marquette Brownstone," "Jacobsville Redstone," and others, was formerly quarried at Portage Entry and Jacobville, Houghton County, Marquette, and other places. Owing, however, to a change in taste for color in building stone, these quarries have been discontinued.

The Sylvania sandstone of Middle Monroe age is a very pure silica sand with very little cementing material. It is quarried at Rockwood, Wayne County, and is in great demand for the manufacture of higher grades of glass, such as plate and optical glass.

The sandstone of the Coldwater and St. Peter Formations are relatively unimportant from an economic standpoint and the Berea Formation is not known in outcrop.

Shale

Shale beds occur at nearly all horizons from the Coal Measures to the Pre-Cambrian. The important beds from an economic standpoint are the shales of the Coal Measures, Coldwater, Bedford, Antrim, and Traverse Formations, and the Cincinnatian group. The Coal Measures shales are quarried for the manufacture of clay products at Grand Ledge, Eaton County; Williamston, Ingham County; Corunna, Shiawassee County; and Jackson, Jackson County. The Coldwater is quarried at Coldwater, Branch County, and was formerly quarried at Union City, Branch County, for the manufacture of Portland cement. It is also exposed at Richmondville, Sanilac County, and between Forestville and White Rock, Huron County. Elsewhere it is heavily covered by drift. The Bedford shale is quarried at Ellsworth, Antrim County, for Portland cement, and the Antrim shale at Paxton, Alpena County, also for cement manufacture. The shales of the Traverse Formation have been used for cement manufacture when encountered locally in limestone quarries. No developments have taken place in the Cincinnatian Series which forms a prominent bluff on the west side of the Stonington peninsula in Delta County. There are important undeveloped deposits of shale

in Alpena, Cheboygan, Charlevoix, and Antrim Counties.

Trap Rock

Trap rock is quarried near Marquette, Ishpeming, and Negaunee, Marquette County; near Crystal Falls, Iron County; and Wakefield, Gogebic County. Large amounts of amygdaloidal basalt are also produced incidental to the mining of copper. Most of this, however, is finely granulated in the extraction of the copper; hence is of little economic importance at the present time, although used to some extent for roads in the vicinity of the copper mines. It is not satisfactory however for surfacing roads subjected to heavy traffic. The quarry product is used for road metal, concrete aggregate, and for roofing granules. The most important reserves of trap rock are located in the copper range which forms the backbone of the Keweenaw Peninsula. Many sites convenient to water transportation are available.

Slate, Granite, Feldspar, Verd Antique

Slate.—Slate, granite, quartzite, feldspar and verd antique marble are not quarried at the present time, although they have been produced at various times in the past. There are large deposits of high-grade slate near Arvon in Baraga County, suitable for most uses to which slate is put. Several companies have operated quarries in the past but were generally unsuccessful, due to inefficient management, lack of sufficient funds, etc. With proper management and adequate capital it seems logical that the Baraga County slate deposits could be developed into profitable operations. Quarrying conditions are good and water power is available at some of the sites.

Granite, Quartzite, Feldspar.—Northwest of Marquette there are extensive exposures of all varieties and colors of granite convenient to water transportation. Quartzite occurs abundantly near Ishpeming and has been quarried and ground for use as wood filler, and in paint and polish. Feldspar dikes of sufficient purity to be of economic importance are known to exist in Gogebic, Ontonagon, and Marquette Counties. Most of the dikes are not extensive but several quarries have been operated at one time or another. The following analysis was made at East Liverpool, Ohio, of feldspar from section 22, T.47 N., R.29 W., near the village of Republic:

SiO_2	65.25	CaO	.38
Al_2O_3	18.60	MgO	.23
Fe_2O_3	0.40	Na_2O	1.99
		K_2O	13.40

Verd Antique.—Michigan has large deposits of verd antique, equal or superior to much of the serpentine and verd antique now on the market, in a series of peridotite dike rocks cutting diorite, diavase, and felsites and appearing as prominent ridges in T. 48 N., R. 27 and 28 W. These dikes have largely altered to serpentine and serpentine with stringers of dolomite, this latter variety being known as verd antique. The stone is firm and hard, takes an excellent polish, and quite large blocks can be secured. Several companies have operated quarries in the past, but a satisfactory degree of success has not been attained. The material has been crushed and used chiefly for terrazzo and pebble dash. In order to put the Michigan verd antique deposits on a profitable basis it is necessary to produce slabs and blocks suitable for interior and exterior decorative purposes.

Sand and Gravel

Origin.—As a result of the action of the last great ice sheet or glacier, sand, gravel, clay, and boulders are so profusely strewn over Michigan as effectively to mask the underlying hard-rock features. The greatest known thickness of the drift cover as determined from deep borings is over 800 ft. In some places it is believed to be as great as 1,000 to 1,200 ft. to bed rock. The Southern Peninsula is more generally and more deeply drift-covered than the Northern Peninsula. Rock is extensively exposed in the extreme northern part of the Southern Peninsula and in a number of places in the south-central portion and along the Lake Erie and Lake Huron shores.

The materials composing the drift are not uniformly distributed over the two peninsulas. The southern half of the Lower Peninsula is predominantly clay, while the northern half is mostly sand. In the Upper Peninsula more variable conditions obtain, owing to a generally thinner drift cover.

Southern Peninsula.—By far the largest resources of sand and gravel for concrete aggregates are found in the southern half of the Lower Peninsula. This is in contrast to the large deposits of limestone which occur in the northern part of the state. On first thought, this inland concentration of road-making and building aggregates in close proximity to the large cities of the state would appear to be a distinctly favorable situation and such has been the case in the past. In recent years, however, competition from Canadian and Michigan companies operating in deposits located convenient to water transportation has greatly reduced the present importance of the large interior deposits in the southern half of the Southern Peninsula. Sand and gravel can be shipped by water from points in northern Michigan and Ontario to Detroit, the chief market, at much lower rates per ton than from the interior deposits within a radius of 50 mi. from Detroit. As a result we may see in the next few years intensive prospecting along the northern shores of Lake Huron and Lake Michigan, by some of the larger companies now operating, for the purpose of developing deposits convenient to water transportation. Many of the extensive interior deposits may therefore revert to the status of future reserves, again to assume importance when the near-shore deposits have become depleted.

In the southern half of the Lower Peninsula conditions of deposition appear to have followed a more normal course than in the northern portions of the state. The largest deposits occur in outwash plains, which are formed by materials washed out from the front of melting ice sheets, in deltas, and in glacial drainage channels, chief of which is the Maple-Grand River channel by which the waters of

Lake Saginaw drained into Lake Chicago. Kames and eskers, features formed from the action of superglacial and subglacial streams, also constitute important resources of sand and gravel.

There is a belt of variable width, extending from the Ohio state line about 35 mi. west of Lake Erie along the lake shore as far north as Alcona County, which contains relatively little gravel of commercial possibilities. The belt represents an overlap of the earlier Great Lakes and is composed chiefly of lake-laid clay and sand with the coarse material largely found in the old beach ridges and deltas at the margins of the basin. Inspection of the map accompanying this article will show that the belt has few commercial gravel plants and the deposits supporting them are largely the result of reworking by means of wave or stream action.

The northern half of the Southern Peninsula appears to have had a somewhat different glacial history from the southern half with a corresponding variation in economic products. Gravel does not appear to be concentrated to the extent that it is in the southern part of the state, but occurs rather in numerous small pockets of from a few hundred to several thousand cubic yards each, thus greatly decreasing its value for anything but small requirements. On road jobs in this part of the state it is often necessary to use a small movable plant and work as many as a dozen such deposits before enough material is secured for the job. In a few localities, however, there are deposits comparable to some of those in the southern part of the state.

Northern Peninsula.—Sand is of course present in enormous quantities in the northern part of the state. Most of it is, however, too fine and too uniform in grain size for construction purposes. Much of it would undoubtedly be suitable for foundry purposes, but, owing to the development of the extensive sand-dune deposits, it is doubtful if this interior sand will ever be of importance unless the exploitation of the sand dunes should be prohibited by legislative action for the purpose of preserving them for scenic and recreational values.

With regard to gravel resources the Northern Peninsula is similar to the north half of the Lower Peninsula in that there are fairly large deposits in some localities but in other large areas gravel is almost nonexistent, in fact to the extent that a number of cities and counties in the western half of the peninsula operate stone quarries to obtain material for their road- and street-construction work. There are commercial gravel plants located near Escanaba, Iron Mountain, Iron River, and Marquette.

Quality of Gravel.—The character of sand and gravel in Michigan varies considerably from place to place. Where the drift is thin, the gravel is likely to contain a large percentage of stone derived from the underlying bed rock or from rock strata not greatly distant. The quality of the gravel will then depend largely upon the character of the bed rock from which it was derived. Considerable portions of Jackson, Calhoun, and Kalamazoo Counties in the southern part of the state are underlain at shallow depths by the Marshall sandstone and much of the gravel in these counties contains sufficient of this sandstone to render it unfit for concrete aggregate and inferior for road surfacing. A similar situation is encountered along the south shore of Lake Superior from Sault Ste. Marie to Marquette, where the Cambrian sandstone is the underlying formation. This sandstone has the advantage of being firm and hard in contrast to the Marshall sandstone. It is, however, classed as absorbent and is not generally satisfactory in concrete aggregate.

In the St. Ignace Peninsula there is abundant gravel in old beach ridges but it is almost entirely composed of soft limestone, much of which is of a shingly nature. Consequently, most of the gravel is unsatisfactory for concrete aggregates.

Owing to generally thin drift cover in the Northern Peninsula and underlying limestones, sandstones, and shales, it is very difficult to develop a deposit suitable for concrete aggregate in the eastern half of the peninsula. In the western half of the peninsula the underlying rocks are igneous, metamorphic, and indurated sedimentary; hence the gravel is of much better grade and is suitable for all purposes to which it is usually put. Where the drift is thick, as in the central part of the Southern Peninsula, the gravel is generally of good grade unless contaminated with clay balls, iron oxide, or lime cement. Gravel in this part of the state usually runs about 65 per cent. limestone and dolomite, the remainder being igneous rock and chert. The calcareous rocks are, however, of the resistant types, since the softer varieties have been ground up in the process of being transported long distances.

In 1929 Michigan produced 16,844,099 tons of sand and gravel, valued at $7,928,744, and ranked fourth in the industry.

Gypsum

Occurrence.—Michigan has been one of the leading states in gypsum production for many years. Gypsum occurs in commercial quantities in the Michigan Formation of the Mississippian period and in the St. Ignace Peninsula. Gypsum is encountered in the Michigan Formation by deep wells in practically all parts of the state where the formation occurs. In many localities it occurs in beds of minable thickness, but in only two areas are the beds sufficiently near the surface to be of economic importance at the present time. The oldest developments are in the Grand Rapids-Grandville district, Kent County, where three and possibly four gypsum beds are worked. The beds are respectively 6, 12, and 22 ft. in thickness, the lowest bed having a shale parting of 1 ft. near the middle. Mining is entirely underground at the present time although quarries were formerly operated. The shafts are from 75 to 100 ft. in depth.

The other gypsum district is located in southeastern Iosco County, with developments at Alabaster and near Emory Junction, at both which places quarries are in operation. At Alabaster the upper bed, which is the only one quarried, is 18 to 23 ft. thick. Test drilling, however, shows that several other beds from 5 to 25 ft. thick are present. The bed worked at Emory Junction varies from 8

(Continued on page 34)

Problems Confronting the Producers of Talc and Allied Minerals

By J. B. AIKMAN
Manager and Asst. Treasurer, Vermont Talc Co.

THE group of minor nonmetallic minerals intended to be covered by this discussion includes talc, feldspar, fluorspar, barytes, whiting, magnesite, mica, silica and various others of this class. It does not embrace the larger industries such as cement, limestone and its products, crushed rock and building stone, asbestos, gypsum and others of similar character.

While the annual production in both tonnage and value of this entire minor group is quite small when compared with the larger, it is probable the total capital investment therein for plants and working funds is greater in proportion to the dollar value of business done than in the other group.

Take, for instance, the talc industry, in which the writer is engaged and which is somewhat older and more fully developed than some of the other nonmetallic-mineral industries in this class. It will be interesting to those not informed to know that in only one year since the close of 1913 has the total volume of business reached $3,500,000. In most of those years it was in the neighborhood of $2,000,000 to $2,500,000, with an occasional dip below $2,000,000.

The total annual tonnage produced and sold has been in the vicinity of 200,000 tons, with a change now and then of 10,000 tons above or below this amount. And these figures, it should be remembered, include all grades and forms of talc and soapstone.

The number of producers has ranged from around twenty to twenty-eight, which would indicate that the average business done by each was extremely small. But it is even worse than this because of the fact that far more than half the talc and soapstone of the country has always been produced and sold by not more than a half-dozen concerns. The average amount left for each of the other eighteen or twenty plants is clearly insignificant.

Despite these facts, which come from annual reports of the United States Bureau of Mines, Department of Interior, and are therefore available to anyone making the most superficial investigation, people are led to invest in new enterprises in this field. Indeed, according to the same government reports, five new operators entered the talc and soapstone business in 1930. These, together with two that discontinued operations, brought the total number of operators for last year up to twenty-eight, or three more than in 1929, and yet almost anyone should have known that 1930 was a highly unfavorable year for any new operations to be started in nonmetallic minerals. The same condition exists in most of the other nonmetallic minerals of this group, especially those that equal or exceed talc in the extent and period of their development.

The main hope for all these enterprises lies in the fact that most of them are relatively new, representing in nearly all cases developments made since the beginning of the present century. Their potential importance is great, but the realization of their future possibilities will not occur in full measure for many years hence.

Referring again to talc, while it is used in greater or less amounts in perhaps a hundred different ways, hardly more than eight or ten industries take it in car-loads, the requirements of others running from a few pounds to four or five tons each per year. And, of course, unless more than 90 per cent. of the business of such a cheap material were in carloads, no producing concern could long exist.

The trouble, therefore, with the industries under this head is not in production methods, but almost wholly in marketing problems. Not only must we all face the competition of others in our own line, but the more serious competition of other materials.

The paper industry is the most important consumer of finely-ground talc of the grades produced in Vermont, with which the writer is most familiar. Moreover, with the exception of New York, Vermont produces greater quantities of talc than any other state, in fact more than most of them combined. And still the available tonnage is insufficient to support profitable operations.

The industry referred to also uses other materials as fillers. Some of these are not only preferable but actually better for certain grades of paper. Then there are some grades produced in liberal tonnage for which talc is better than any other filler, and yet it is difficult to hold such business permanently due to their vacillating tendency to use different kinds of materials for this purpose. The same problems are met in other industries that are classed as liberal consumers of talc.

Now it is a fact that all nonmetallic minerals are subject to considerable variation. For instance, the talc produced in northern New York, southern California and Vermont, as well as other states, differs sharply in both physical and chemical properties. Moreover, some, though a much smaller, difference exists in talc that comes from different parts of the same deposit.

Fortunately, however, in the larger uses of talc its physical properties are of paramount importance, while its chemical aspects are not so much so. The reason for this is that it is not subjected in its use to temperatures high enough to decompose it and

therefore no chemical reaction, which might give rise to unsatisfactory results, takes place.

Generally speaking, in the case of feldspar and some other minerals the opposite situation prevails. Indeed, the importance of the chemical properties of feldspar is obvious when one recalls that market reports, in order to identify different spars, nearly always indicate the most important chemical combinations in the material quoted. In other words, to identify a given feldspar properly it seems necessary to state its most important chemical combinations in describing it.

It is clear therefore that a great deal is yet to be learned, especially by consumers, as to the beneficial properties and uses of all these minor nonmetallic minerals and the sooner this is done the better it will be for the users as well as the industries that produce such materials.

Therein also lies the intriguing interest of the whole subject. All these products call for the most advanced scientific research and should make a strong appeal to the interest of those engaged in their production. There, again, economic difficulties arise to trouble us. The comparatively insignificant amount of money available from the active operations of those engaged in producing these materials is hardly sufficient to warrant the research expense that should be devoted to the subject.

It would seem that producers of materials in this minor group would be greatly helped if all could take a broader view of our problems, abandon reticence as to our own knowledge and experience, and contribute to the general fund of information that will be available alike to producers and consumers of these products.

Since authentic knowledge of these various nonmetallic minerals still remains scattered and fragmentary and therefore sometimes difficult to find, the trade publications like PIT AND QUARRY apparently offer the best and only efficient means for receiving and distributing new facts of value pertaining to our problems. Since they are willing and eager to do this, greater coöperation should be cheerfully accorded them by producers for, in the long run, the latter will be the chief beneficiaries from such a policy.

Nonmetallic Minerals of Michigan

(Continued from page 32)

to 30 ft. in thickness and has an overburden of clayey loam averaging about 8 ft. in thickness. This bed has not been definitely correlated with the one worked at Alabaster. Undeveloped deposits occur in the vicinity of the villages of Turner, Twining, and Harmon City, Arenac County.

The gypsum beds in the vicinity of St. Ignace have not been worked for a great many years and probably will not again become of importance in the near future. From what data we have on these deposits, however, they do not appear to have any serious disadvantages and hence should constitute satisfactory reserves.

In 1929 Michigan produced 898,547 tons of gypsum valued at $4,315,334 and ranked second among the states in the quantity produced.

Portland Cement

From its definite establishment in 1896 the cement industry in Michigan has enjoyed a steady growth to the position of second rank to Pennsylvania in 1929. There are at present 14 producing plants in the state, 12 of which are located in the southern half of the Lower Peninsula and two in the northern part of the peninsula. Limestone and clay are the raw materials used at a majority of the plants, although several utilize marl or a mixture of marl and limestone. The plants at Petoskey and Alpena in the northern part of the state use shale exclusively, owing to the large deposits under shallow cover in that part of the state. Two other plants utilize shale in part. Two companies operate their own limestone quarries, while a third secures the "fines" from a quarry operated for the production of alkali. Several plants are supplied with stone from the quarry at Rogers City, Presque Isle County. The wet process is used at all except two plants. In 1929 the cement produced in Michigan amounted to 13,748,862 bbl., valued at $18,916,711.

Lime

The lime-burning industry early became of importance in the southern part of the state, especially in Monroe County, where there are numerous exposures of limestone. Wood could be obtained for fuel and the industry flourished until this cheap fuel became increasingly more difficult to obtain and the plants found themselves unable to purchase coal and compete with the lower-cost plants of northern Ohio. As a result lime burning has been discontinued in the southern part of the state and transferred to the northern portion where enormous deposits of pure limestone are available and where wood could still be obtained for fuel. Even in this part of the state the availability of wood for fuel has gradually decreased and the majority of the kilns are now operating on coal, although one plant utilizes producer gas. With one exception, however, the plants can secure coal by water transportation.

Production of lime in Michigan has fluctuated considerably since the inception of the industry. The reasons for this lack of steady growth may be attributed partly to the conditions above described and partly to difficulties the lime industry in general has encountered. The fact that the bulk of the lime manufactured in Michigan is used for chemical purposes likewise favors a fluctuating production curve since adverse conditions would effect the entire industry. Lime produced in Michigan in 1929 amounted to 91,408 short tons, valued at $844,543.

In addition to the minerals and mineral products described in the foregoing, Michigan is an important producer of salt, sand-lime brick, clay products, bromine, calcium, and magnesium chloride.

A.S.T.M. Committees Announce Research Plans for Next Twelve Months

Studies Concerned with Concrete, Lime, Gypsum and Slate Tentatively Outlined

ONE of the most active committees of the American Society for Testing Materials is Committee C-9 on Concrete. The officers, Chairman Cloyd M. Chapman, consulting engineer, United Engineers & Constructors, Inc., New York, and Secretary, Stanton Walker, National Sand & Gravel Assn., Washington, D. C., have recently submitted a report of the activities which the various subcommittees will pursue for the coming year. A few of the problems which are of vital interest to the concrete industry are summarized here.

The committee has under development a proposed symposium on the significance of various tests in judging the quality of concrete. Many experts in the concrete field are directing investigations of various tests which include compressive strength, transverse strength, modulus of elasticity, absorption and permeability, density, volume changes, and others.

Committee C-9 is considering proposing as tentative methods the following:

1. Method of test for soundness of fine aggregate by the use of sodium sulphate.
2. Method of test for soundness of coarse aggregate by the use of sodium sulphate.

This A.S.T.M. Standing Committee is subdivided into seventeen subcommittees which direct its many activities.

Subcommittee VII is investigating strength tests of concrete which include methods of capping, methods of loading concrete beams, a study of concrete flow tests and a procedure for making specimens where the aggregate used is from 2 to 6 in. in size.

Concrete specialists have been giving more and more attention to permeability and tests for this property, and subcommittee VIII is doing work along these lines. Bomb-type permeability apparatus has been investigated, a bibliography is in preparation, and coöperative tests are being investigated and run.

Subcommittee IX on Specifications and Methods of Tests of Aggregates has a great deal of research work before it. This includes soundness of aggregate, abrasion, effect of stone dust in concrete, test to ascertain the amount of soft or rotten particles in aggregates and suitability of stone slag, slag sand, and crushed gravel-sand for use as fine aggregate, and several other related subjects.

Extraneous substances in concrete are being studied by a subcommittee. Some of the investigations which have been assigned to various committee members include: Effect of mica in sands; effect of shale, clay and silt in aggregate; and the effect of organic matter and oil-bearing aggregates.

Testing apparatus is being studied by one of the subcommittees.

One important subject is the measurement of materials and the mixing and placing of concrete. Subcommittee VII is studying and correlating data in this field. A bibliography on mixing is being reviewed, the composition of fresh concrete is being studied and an investigation of ready-mixed concrete is in progress. The use of vibrating tools for placing concrete will be considered and studied.

At the recent annual meeting of the A.S.T.M., the Committee on Cement submitted five tentative specifications relating to the curing of concrete. These were promulgated under the sponsorship of Subcommittee XIII on Curing of Concrete. They follow:

Tentative specifications for curing Portland-cement concrete.

Tentative specifications for curing Portland-cement slabs with bituminous coverings.

Tentative specifications for curing Portland-cement concrete slabs with calcium-chloride admixture.

Tentative specifications for curing Portland-cement concrete slabs by surface application of calcium chloride.

Tentative specifications for curing Portland-cement concrete slabs with wet coverings.

In addition, this committee plans to prepare specifications covering the curing of Portland-cement concrete slabs with sodium silicate and for curing in cold weather.

Subcommittees on the workability of concrete, admixtures, and elasticity and volume changes of concrete have several items to study and investigate in the specific fields governed by them.

Ready-mixed concrete is an engineering product which has rapidly come to the fore and Committee C-9 has recently appointed a subcommittee to investigate the present practice and draw up specifications covering proportion and consistency; measurement, mixing and delivery; and inspection, tests and acceptance.

Committee on Lime

The A. S. T. M. Committee on Lime has several projects which are to be undertaken soon. It is expected that the Standard Specifications for Hydrated Lime for Structural Purposes will be further revised. This will be based on experimental work to be done in connection with the determination of plasticity. The question of soundness has again been brought up and it is probable that the sections of the specifications covering this property may be revised to cover all types of hydrated lime. The National

Bureau of Standards has developed a new method for testing the soundness of limes and the committee, after investigating this, may substitute it for the existing specified method.

The drafting of a standard specification for pulverized quicklime is dependent on the publishing of the new method for soundness which is being developed at the Bureau of Standards, and, as soon as this is done, the subcommittee in charge will begin active work.

The new method for soundness is very reliable and it is of especial importance in reducing the time necessary for a determination from the present requirement of 4 days to 3 or 4 hr.

A new subcommittee has been formed, under the chairmanship of Prof. J. R. Winthrow, Ohio State University, to study various problems regarding lime. Suggested research topics are: Effect of particle size on the physical characteristics of lime, such as plasticity, cementing value and water-lime ratio; a study of the use of accelerators combined with fine grinding; the comparative slaking rates of shaft- and rotary-kiln lime; and the effect of aging lime putty.

A Subcommittee on Lime for the Chemical Industries is giving consideration to the preparation of specifications for lime for the manufacture of glass, and also for the manufacture of calcium arsenate. This group also expects to make an industrial survey to determine the existence of an actual need for further specifications for lime products in this field.

W. V. Brumbaugh, assistant secretary, National Lime Assn., is secretary of the A. S. T. M. Committee C-7 on Lime.

Committee on Gypsum

The Committee on Gypsum, of which H. J. Schweim, chief engineer, Gypsum Assn., Chicago, is secretary, has outlined an interesting program of work for its four subcommittees.

The Subcommittee on Gypsum for Various Uses will begin a correlation of the work being done by different investigations throughout the world on the uses of gypsum and anhydrite. It will at the same time continue the investigation of the uses of gypsum and anhydrite as a retarder for Portland cement. The Non-Metallic Minerals Experiment Station of the Bureau of Mines is co-operating in this work.

The committee which functions in the field of gypsum plasters has undertaken an investigation of the suitability of the modified vicat apparatus for determination of standard consistency of gypsum ready-sanded and gypsum wood-fiber plastics. It will also make a determination of time of set of gypsum neat plaster with and without standard testing sand, and investigate the tensile-strength requirements for gypsum neat-wood fiber, and sanded plasters, and calcined gypsum for finishing coat in Standard Specifications for Gypsum Plasters (C 28-30).

Structural Gypsum Products which are under Subcommittee III will make a determination of volumetric changes in neat gypsum and gypsum-fiber concrete under varying temperature and humidity conditions. It will also investigate the advisability of either omitting Section 15 "Transverse Strength of Gypsum Partition Tile or Block" from Standard Specifications for Gypsum Partition Tile or Block (C 52-27) and also from the corresponding Section 25 from Standard Methods of Testing Gypsum and Gypsum Products (C 26-30) or including a transverse strength value in the specifications for gypsum partition tile.

Subcommittee IV on Testing Methods has undertaken a study of test methods of gypsum products and their relation to specifications and standard practice. This group will also investigate the method of determining the sand content of set plaster and the possibility of slow-setting neat plaster specimens drying out; thus making the formation of briquettes for testing purposes impractical.

Committee on Slate

Committee D-16 on Slate has submitted a report of its proposed activities for the ensuing year through the secretary, D. Knickerbacker Boyd, Structural Service Bureau, Philadelphia.

This committee will propose that the Tentative Methods of Test for Determining the Electrical Insulating Qualities of Slate (D 273-27 T) be advanced to standard during the coming year.

Subcommittee V on Weathering Characteristics has accomplished much in accumulating necessary data. A symposium on Weathering Characteristics of Masonry Materials at the recent Chicago meeting included a paper by G. F. Laughlin and C. H. Behre on slate weathering. When sufficient data are assembled a tentative method for testing the weathering qualities of slate will presumably be adopted, but just when this will be accomplished is difficult to predict, because it seems desirable to correlate the work with similar investigations being made by other committees, particularly Committee D-18 on Building Stone. Further work will be done during the coming year in assembling necessary data for a tentative method of test.

Much work has been done by Subcommittee X on the standardization of samples and the work will be continued during the coming year.

Texas Sulphur Production in First Six Months 608,730 Tons

Production of sulphur in Texas during the quarter ended June 30, 1931, amounted to 608,730 tons, compared with 649,594 tons in previous quarter and 711,966 tons in the second quarter of 1930.

The Texas Gulf Sulphur Co., from its Matagorda and Wharton County fields produced 374,049 tons, compared with 403,684 tons in the previous quarter and 490,930 tons in the like 1930 quarter.

The Freeport Texas Sulphur Co., in Brazoria County, produced 223,620 tons, against 234,105 tons in quarter ended March 31, 1931, and 209,790 tons in the quarter ended June 30, 1930.

Duval Texas Sulphur Co., in Duval County, produced 11,061 tons as contrasted with 11,805 tons in the previous quarter and 11,246 tons in the like quarter a year ago.

Pit and Quarry

With which is consolidated

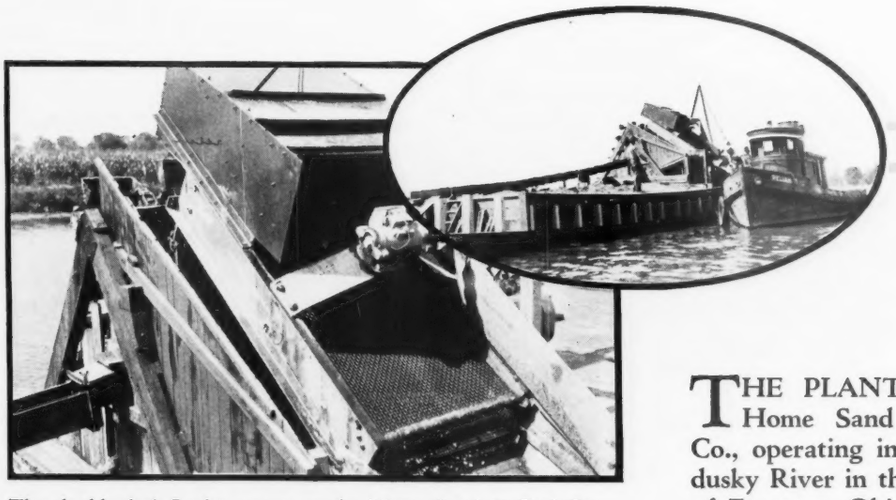
CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

The First Paper Devoted to the Production of Non-Metallic Minerals

ANNUAL SAND AND GRAVEL SECTION



The double-deck Leahy screen on the Home Sand & Coal Co. dredge; in oval, the dredge and towboat.

THE PLANT of the Home Sand & Coal Co., operating in the Sandusky River in the vicinity of Fremont, Ohio, consists of a combination dredge and barge. All the screening is handled, efficiently and economically, by the double-deck Leahy screen illustrated. The upper deck serves as a scalper; the lower classifies two grades of sand. If you want economical and efficient screening—regardless of the size of plant—there is a Leahy for you. *May we give details?*

Big Plants
or
Little Plants

THE DEISTER CONCENTRATOR CO.
(INCORPORATED 1906)
911 Glasgow Ave., Ft. Wayne, Ind.
New York Office, 104 Pearl St.
New York

THE Leahy VIBRATING SCREEN

How this Morris Dredge

helps to provide speedy—economical—dependable sand and gravel production

THE practical and efficient plant of the Albany Gravel Company at Croton, N. Y., not only makes use of practically 100 per cent of the materials in its 15-acre deposit, but does so in a remarkably quick and economical manner. This deposit of more than 1,500,000 cubic yards averages about 85 per cent sand and 15 per cent gravel, and within a few minutes after the Morris Dredge draws the material from the pit, it is divided into two sizes of sand and three sizes of gravel and stocked into piles and bins ready for loading onto trucks.

The Morris equipment used by this plant includes a dredge with an 8-inch manganese steel lined centrifugal pump, a 4-inch pump used to prime the dredging pump and also to furnish water for loosening up the deposit and for caving the bank into the pit, and another 4-inch pump to supply wash water for the plant.

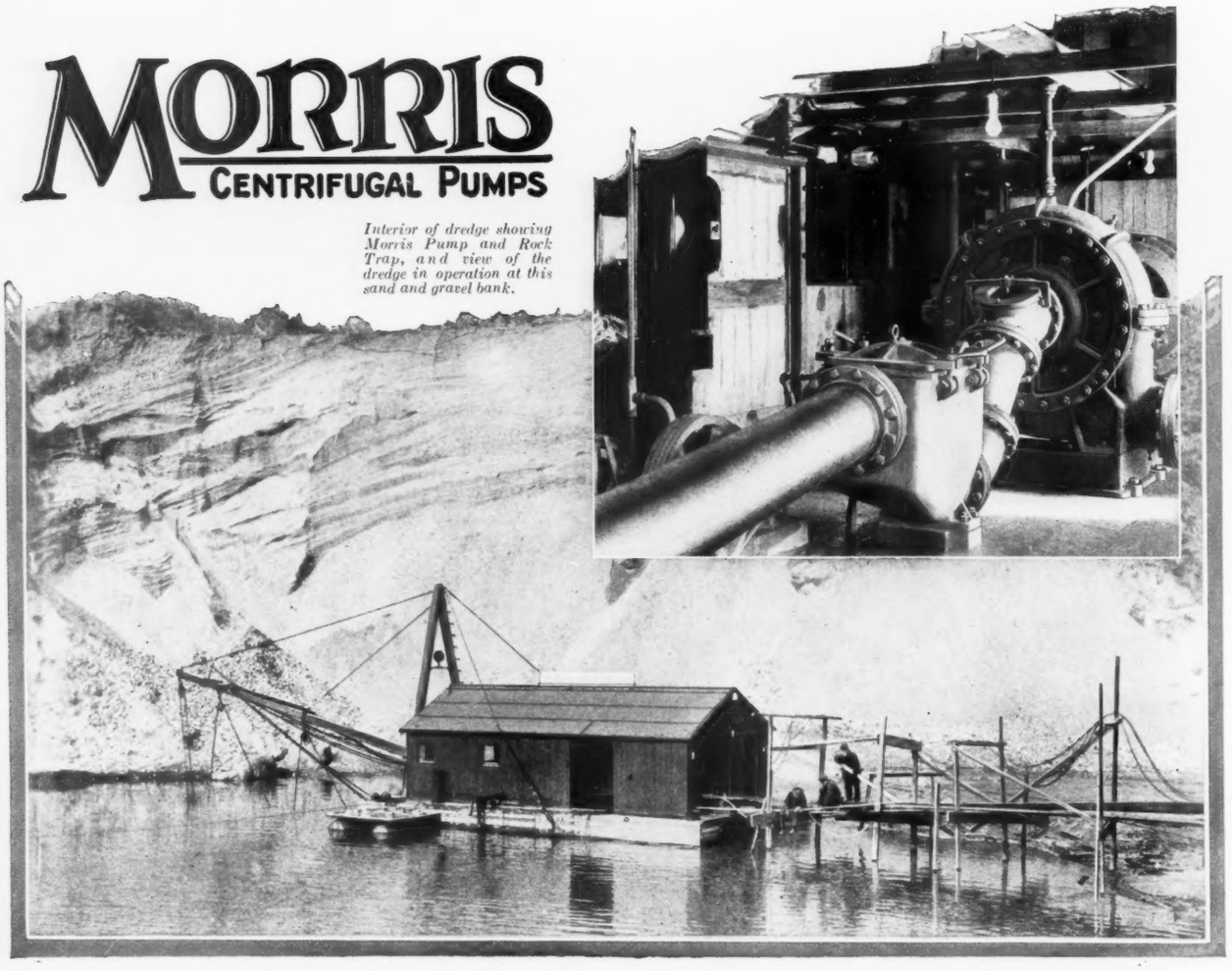
Only four men are required to operate the plant at capacity and the equipment, including a screening plant and a crusher for part of the gravel and also the large rocks which are caught in the Morris Rock Trap, is sufficient to recover all the material in the bank withdrawn by the Morris Dredge.

Your own deposits may permit similarly simple and economical methods of sand and gravel production. The Morris Engineers will be glad to study your requirements and offer authoritative recommendations without charge or obligation.

Write for full information.

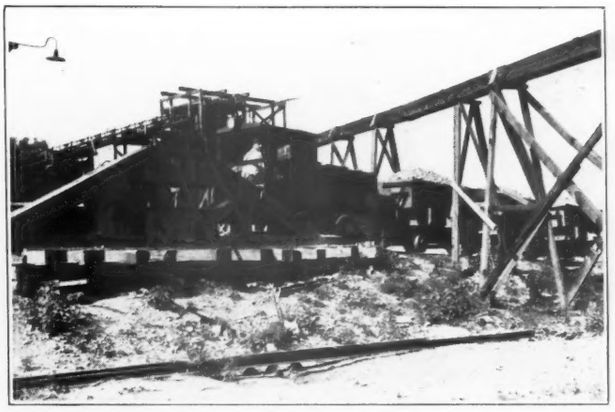
MORRIS MACHINE WORKS
Baldwinsville, N. Y.

MORRIS
CENTRIFUGAL PUMPS



Interior of dredge showing Morris Pump and Rock Trap, and view of the dredge in operation at this sand and gravel bank.

Steam shovel loading cars in the pit.



Train at track hopper. Note inclined dumping rail.

Automatic Dump Cars Simplify Handling of Gravel at Tennessee Plant

Primary and Secondary Crushers Operate in Closed-Circuit with Scalping Screen

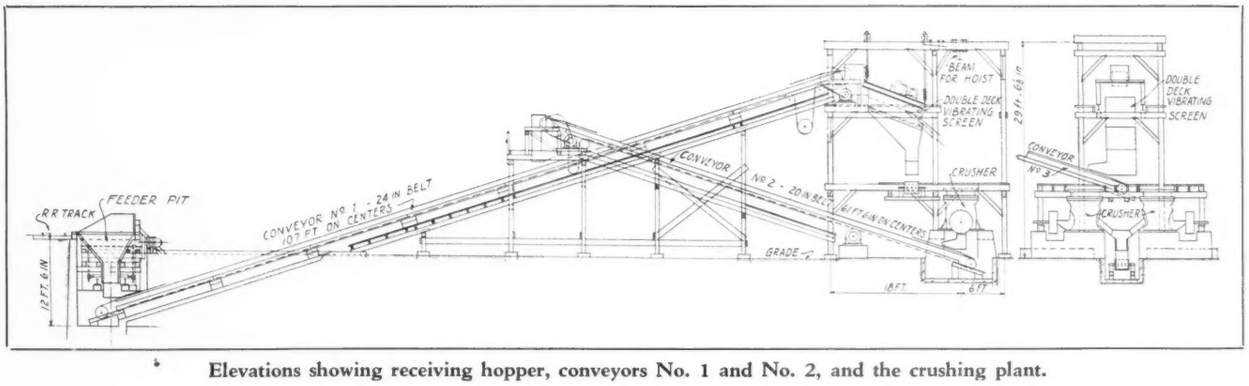
By MAT F. BEISBER

REFLECTING modern tendencies in plant design, a new sand-and-gravel plant in the eastern Tennessee district will be of interest to the industry. This district, which also produces crushed stone, serves the aggregate requirements of the neighboring portions of the states of Virginia, West Virginia, and North Carolina, all which have been engaged in extensive highway-construction programs. Future construction work bids fair to offer a continued sizable market, and, as can be readily imagined, the new plant about to be described is not alone in its field; in fact, three new aggregate plants were erected in and about Elizabethton, Tenn., during 1930.

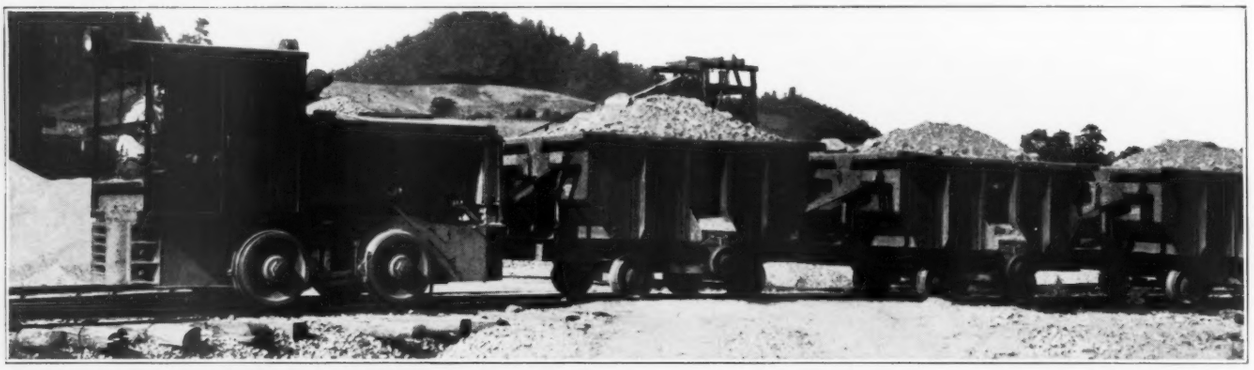
The East Tennessee Sand & Gravel Co., the corporate name of the new company, operates on the former bed of the Wautauga River near the outskirts of the city of Elizabethton. It is a subsidiary of the Franklin Limestone Co., Nashville, Tenn., well-known crushed-stone company which operates four quarries in Tennessee. The new plant was designed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., and has a rated capacity of 2,000 tons per 10-hr. day. Production of gravel began Aug. 1, 1930.

Chief of the features of this plant's design is the complete reduction to size of all materials at ground level, circulating loads being eliminated. This ideal condition has been achieved by the use of a double-deck vibrating screen as a scalper, the top deck rejecting material for a primary crusher, the bottom deck rejecting material for a secondary crusher mounted adjacent to the primary unit. All crushed material is returned to the scalping screen by a short inclined belt-conveyor, and only the "throughs" pass to the screening plant. Another feature of interest is the use of automatic dump cars in the pit-to-plant transportation system.

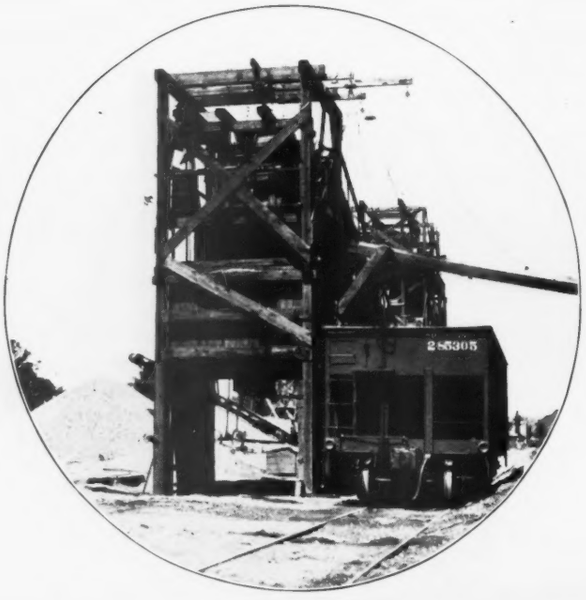
The present holdings of the company include approximately 150 acres of land which was the former bed of the Wautauga River. Beneath a light overburden of silt is found a 10-ft. bed of excellent material, which consists of 40 per cent. sand and 60 per cent. gravel, the latter being in boulder

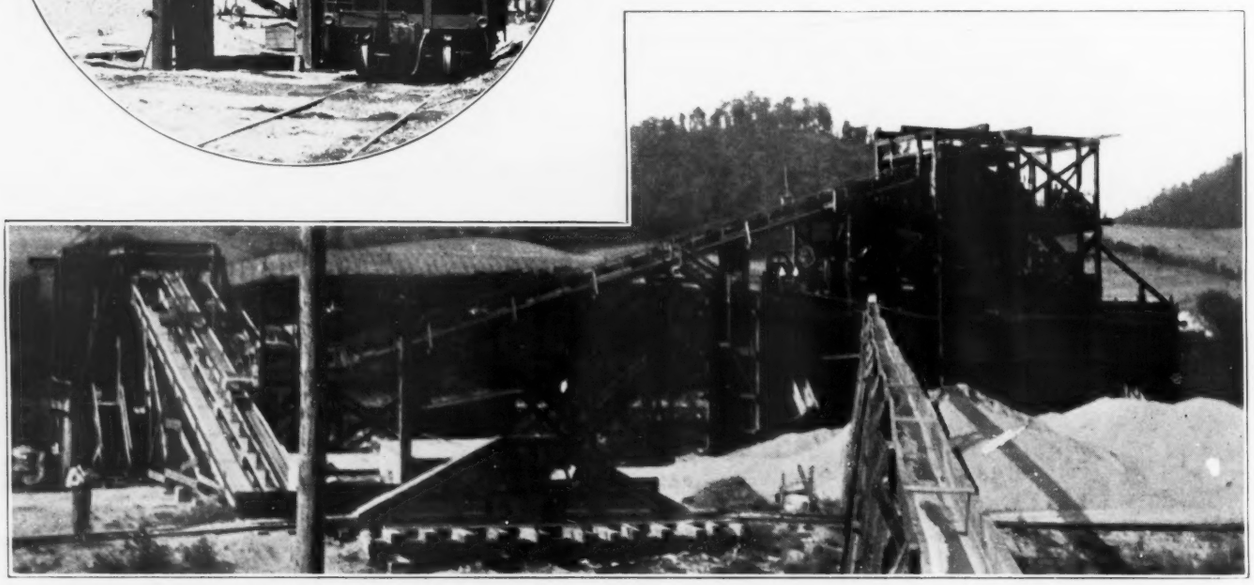


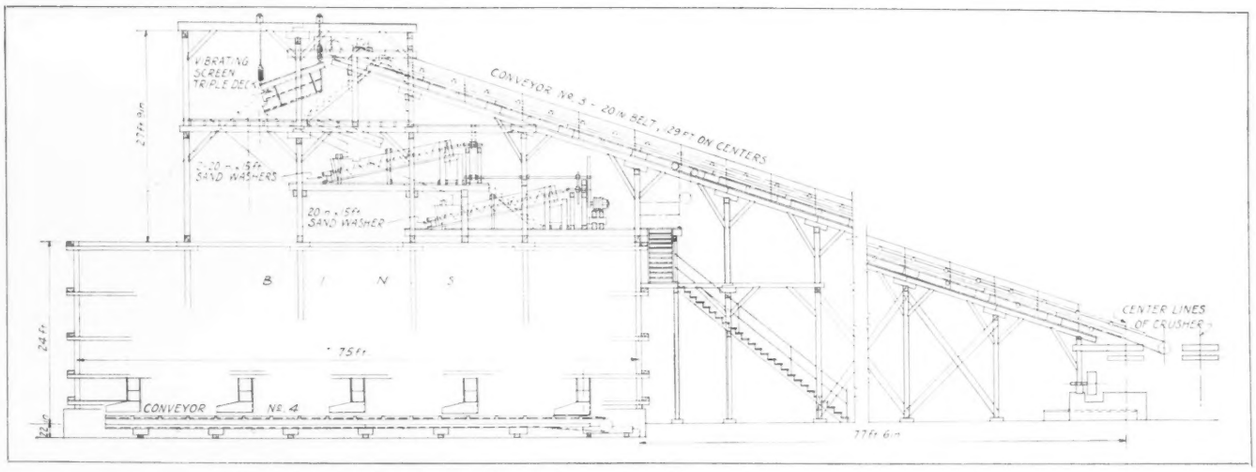
Elevations showing receiving hopper, conveyors No. 1 and No. 2, and the crushing plant.



Above—Intra-plant transportation equipment; note dump wheels on car bodies. *Left*—A view of the pit which at one time was the bed of a river. *Below*—Upper deck of the sand classifiers showing notches in helices. *Bottom*—General plant view with track hopper in foreground. *In circle*—Rinsing-and-loading platform for cars and trucks.






VIBRATING SCREEN TRIPLE DECK
CONVEYOR No. 3 - 20 IN. BELT, 29 FT. ON CENTERS
20 - 5 FT. SAND WASHERS
20 - 5 FT. SAND WASHER
BINS
75 FT.
CENTER LINES OF CRUSHER
CONVEYOR No. 4
77 FT. 6 IN.

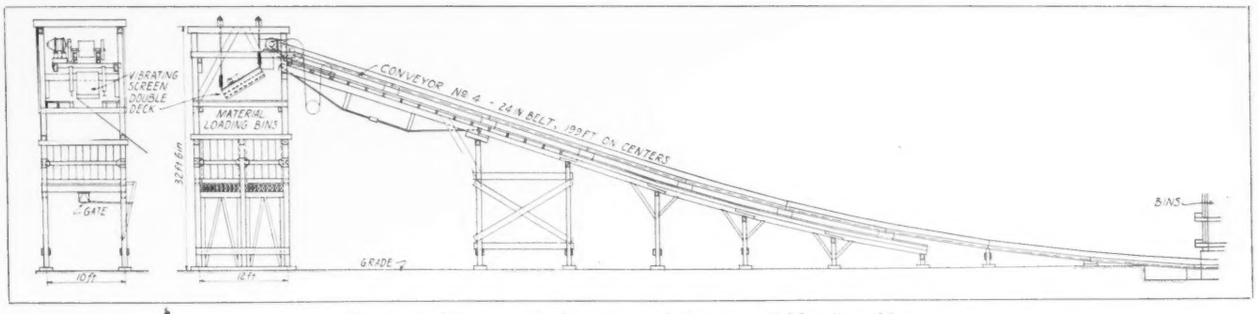
Elevation showing the washing-and-screening plant and conveyors No. 3 and No. 4.

formation requiring practically 100 per cent. crushing of the gravel. Beneath the 10-ft. bed is encountered a layer of clay-silt, which is, in turn, underlain with a good gravel deposit. Present excavation is recovering material only from the upper 10-ft. bed, there being sufficient acreage to provide a plentiful supply for a number of years. Excavation of the pit is made with a Bucyrus-Erie B shovel.

Two trains of Easton, 4-cu.yd. steel side-dump cars, each drawn by a Plymouth type C, 8-ton gasoline locomotive, provide transportation to the plant. An extensive track system has been built to provide a separate return track to a point near the shovel position. As a loaded train nears the dump-hopper which feeds the first conveyor it encounters a slight grade, which elevates it from the pit level to the plant level. The car-bodies of the train are of the single-side-dump type equipped with small wheels on the sides which do not dump. At the track hopper an inclined rail has been built so that, when the car is drawn to the dumping position, the small wheel reaches the inclined rail and rolls upward, causing the car body to dump its load into the hopper. The inclined rail is followed by a horizontal one and then by another, which declines to the ground. Thus a train of cars can be drawn to the hopper and one car after another automatically dumped. As the cars are necessarily dumped from one side only, they are returned to the shovel on a straight-line track without loop turn-arounds. Opposite the track hopper the track is extended into a building which houses the two locomotives when they are not in use.

The track hopper is in reality two hoppers, each being equipped with an apron-feeder. The hopper is 8 ft. wide and 22 ft. long, placed in a pit which is 10 ft. deep. Steel rails, spaced 7 in. apart, prevent boulders and "niggerheads" from getting into the hoppers. Each feeder is 30 in. wide and 5 ft. long between centers and is operated by a ratchet mechanism from a single 7½-hp. motor, which drives both feeders. The feeders discharge directly to the tail-pulley end of the first plant conveyor. This unit, No. 1, extends from the hopper-pit to the scalping screen. It has a 24-in. belt 107 ft. long between centers and is driven by a 15-hp. motor. The conveyor is inclined at an angle of 18 deg. In this and in all other conveyor units of the plant, Goodyear belting and Stearns conveyor equipment are standard.

Conveyor No. 1, therefore, delivers pit-run material to a scalping screen, the operation of which constitutes the outstanding feature of the plant. The scalping screen is an Allis-Chalmers 4-ft. by 8-ft. double-deck unit suspended in a position to feed by gravity flow a primary and a secondary crusher, and the screening-plant conveyor. The top deck of the screen is fitted with a 3½-in. wire-cloth panel and the bottom deck with a 2-in. wire-cloth panel. Rol-man screens are used exclusively on all vibrating-screen units. "Rejects" from the top deck are chuted direct to an Allis-Chalmers Gates type No. 5K gyratory crusher which is set to a 2-in. reduction. The "rejects" from the bottom deck are chuted directly to a Symons 3-ft. cone crusher, which is set for minus-1-in. reduction. Both crushers are driven by 40-hp. motors and are



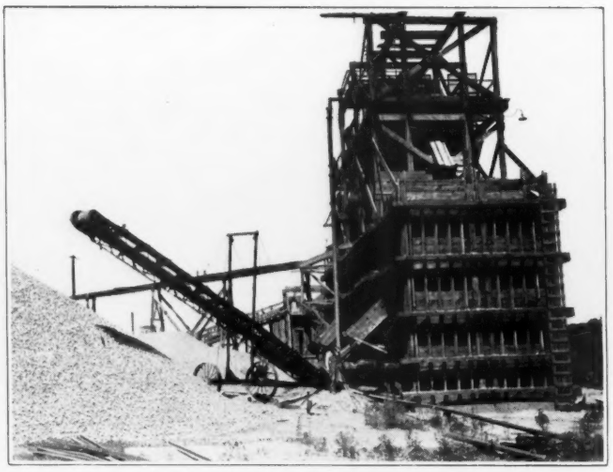
Conveyor No. 4 and elevations of the material-loading bins.

mounted side by side; a common discharge is made to a return-circuit conveyor, No. 2, which extends to conveyor No. 1 for the return of the crushed material to the scalping screen. Therefore, only materials of satisfactory size reach conveyor No. 3, which delivers them to the screening plant. Conveyor No. 3 has a 20-in. belt, is 129 ft. long between centers, and is built on wooden bents at an angle of 18 deg. It is driven by a 10-hp. motor and is equipped with a non-reversing mechanism at the head pulley.

The principal processing equipment consists of a series of two vibrating screens and three screw-type sand-washers, all mounted directly above the bin structure. First in the series is an Allis-Chalmers triple-deck 4-ft. by 8-ft. vibrating screen which washes and classifies gravel above ⅜ in. in size. Usually, 1-in.-mesh wire-cloth is used on the top deck, ¾-in. on the middle deck and ⅜-in. on the bottom deck, all being changeable to meet order requirements. Wash-water is supplied to each screen deck—to the top deck by 5 Binks nozzles and a horizontal spray pipe, and to the two lower decks by spray pipes mounted on the screen-panel frame and connected to the supply line by means of flexible rubber hose.

Minus-⅜-in. material from the Allis-Chalmers screen passes directly to a Niagara 4-ft. by 6-ft. double-deck vibrating screen for the separation of ¼-in. and ⅛-in. materials required for the production of three grades of sand. In connection with this screen three Allis-Chalmers 20-in. by 15-ft. screw-type classifiers and a sand-drag are used. The mounting arrangement of this equipment allows a gravity flow from the Niagara screen to two sand-classifiers which in turn discharge to a third classifier mounted beneath. The sand-drag is built beneath all the above-mentioned equipment. The three sands produced are engine sand for railroad purposes, concrete sand, and masons' sand. For the production of concrete sand only, the lower deck, fitted with a ⅛-in.-mesh wire-cloth panel, is by-passed out so that all minus-¼-in. material passes directly to the sand-classifiers. When engine sand is desired, the ⅛-in.-mesh cloth panel is placed

The fine-gravel classifying screens with discharge chutes.



Portable belt conveyor at stock-pile of excess material.

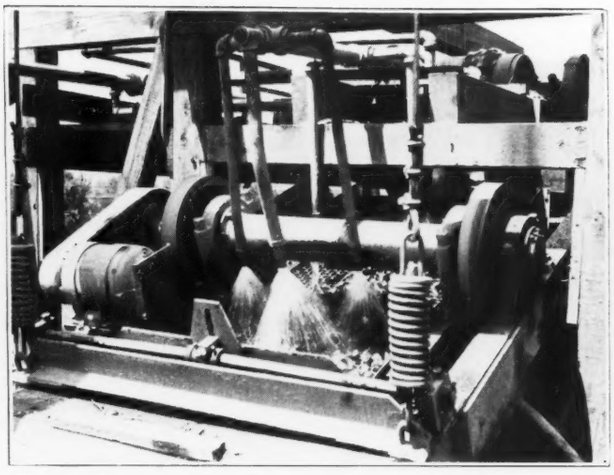
in service, the minus material going to one sand-classifier and thence to its bin, while the plus-⅛-in. to ¼-in. material is sent to the other upper classifier, thence to the lower classifier and, finally, to the finished concrete-sand bin. In other words, the production of engine sand requires the use of minus-⅛-in. sand sent through but one classifier. The classifier screws, incidentally, are notched to provide a spading action in their operation.

From the production of masons' sand, the discharged wash-water from the classifier is flumed to

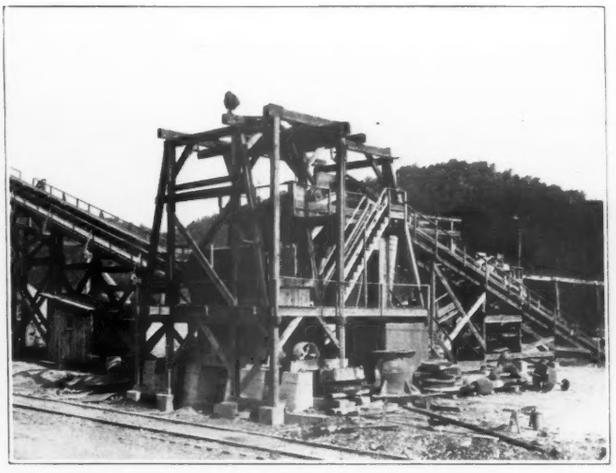
Loading-platform conveyor and the bin-gate equipment.

a sand-drag equipped with 30-in. drags. In the final-discharge flume additional settling tanks have been installed for the same purpose.

In the bin structure no radical departure in design has been made, it being of the usual timber-framing construction. In size it is 17 ft. wide, 75 ft. long and 24 ft. high. The top of the tipple, however, is approximately 52 ft. high. There are 5 bins within the structure, one of which is divided, thus forming 6 bins. Four and one-half car-loads of three sizes of gravel and four car-loads of three grades of sand are normally stored in the structure. In the event the bin storage capacity is not great enough, outside stock-piles are created by means of a Barber-Greene 18-in. portable belt-



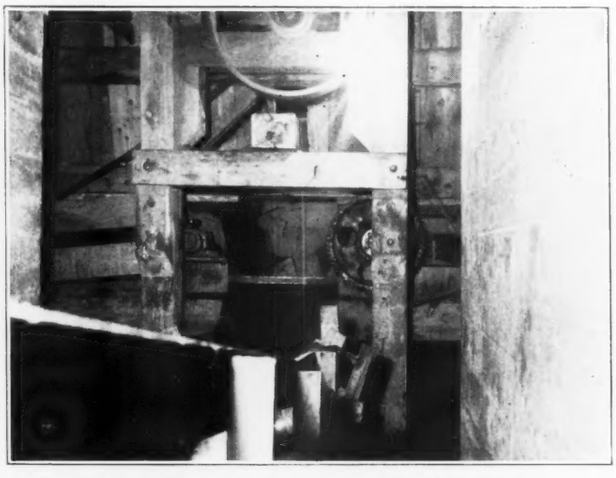
Spray for washing material on vibrating screens.



The crushing plant with scalping screen overhead.

conveyor loader. This unit is fed from bin gates on the north side of the bin structure. With a radial movement, large stock-piles can be created with the minimum movement of the portable loader.

Reclamation of stocked material is usually made by hand-loading small trucks, which are dumped at a small wooden pit-hopper over conveyor No. 1. When a large amount of material is to be recovered, the pit shovel is brought to the stock-pile and a separate track built, thus providing the same excavating and transportation facilities as are used for raw pit material. Thus, when necessary to furnish



View in the track-hopper pit. Note the twin-ratchet conveyor feeders.

a large amount of small-size gravel to meet certain specifications, it is often more profitable to recrush and wash stocked material than to supply it from the pit.

Cars and trucks are not loaded directly from the bin-structure, a separated rinsing and loading platform having been built for this purpose. Finished materials are received from the storage bins on a 24-in. belt-conveyor, No. 4, which is built parallel to the bins and extends to the loading platform, a center-to-center distance of 199 ft., 124 ft. of which forms a curved incline to the rinsing screen. Link-Belt bin-gates are used to regulate and proportion the flow of materials to the conveyor. At the loading platform an Allis-Chalmers 3-ft. by 6-ft. double-deck vibrating screen is employed for a final rinsing of the materials before loading. Normally, ⅝-in.-mesh wire-cloth and 3/16-in.-mesh cloth are used on the top and bottom decks, respectively. The screens, however, merely rinse the materials, which are recombined as they enter the loading chute.

The loading platform is 10 ft. wide, 12 ft. long and 32 ft. 6 in. high. Trucks are loaded from a small bin below the rinsing screen, a clearance of 10 ft. 6 in. having been allowed for the trucks between the loading gates and the roadway. Cars are loaded directly from the rinsing screen on a service track which extends to the main line of the Southern Railway.

As stated, the plant was built from plans furnished by the Allis-Chalmers Mfg. Co., which provided the principal mechanical units as well as the motors and drive equipment.

THE Iowa Highway Commission has found it possible economically to utilize the finer sizes of gravel in constructing its concrete highways. The development of these tests, described by the commission's engineer, are worthy of study. Turn to page 57.

Sand-and-Gravel Industry Attacks Plan to Increase Freight Rates

Representatives Testify at Interstate Commerce Commission Hearing on Aug. 14

REPRESENTATIVES of the sand-and-gravel industry appeared before the Interstate Commerce Commission at Washington, D. C., on Aug. 14 to oppose the railroads' application for a 15-per cent. increase in freight rates. All agreed that such an increase would divert traffic from the railroads to motor trucks and water competitors and would result in an increase in business for wayside-pit operators and a decrease for established operators who have been shipping by rail.

The principal testimony was given by V. P. Ahearn, executive secretary of the National Sand & Gravel Assn. Others who testified were Alexander W. Dann, of Pittsburgh, president, Keystone Sand & Supply Co.; G. W. Renwick, Chicago, vice-president, Chicago Gravel Co.; and Rollin J. Windrow, Dallas, president, Dallas Washed & Screened Gravel Co.

Mr. Ahearn told of the work his organization had done to learn the sentiment of its members on the proposed increase. He said questionnaires had been sent out and a meeting of the association was held in St. Louis, July 31. As a result of the questionnaires and the meeting it was decided to oppose the increase, the membership being solidly against it.

Mr. Ahearn introduced a number of exhibits tending to show that the production of sand and gravel had been steadily increasing, while the tonnage of these commodities handled by the railroads had been dropping during the last few years. He also introduced an exhibit containing replies to the questionnaires sent out by the association concerning the effect of a 15-per cent. increase in rates on sand and gravel, and another exhibit showing replies to a questionnaire concerning recent voluntary reductions in the rates on sand and gravel made by the railroads, and the effect of such reductions in securing or restoring traffic to the railroads which otherwise would have moved by other means of transportation.

In one of the exhibits members of the association agreed that the proposed increase would result in diverting business to other forms of transportation and would aid in developing wayside pits.

An affirmative answer also was given to a question as to whether the existing basis of sand-and-gravel rates had resulted in established plants losing business to wayside-pit operations.

Only three out of 47 companies thought that an increase in freight rates would produce actual additional revenue for the railroads. Most of the companies insisted that, instead of obtaining additional revenue, the railroads would suffer a decline.

The producing companies also were all agreed that they were facing financial difficulties at least as great as those faced by the railroads. One company said it was seriously considering entering the wayside-pit field.

Answers to the second questionnaire said that reductions in rail-freight rates had been followed in all cases by an increased movement of sand and gravel.

The sand and gravel witnesses told the commission that, if an increase finally was decided on, it should be in cents per 100 pounds instead of on a percentage basis.

The association is now preparing a brief incorporating all its arguments which will be submitted to the commission before Sept. 1. Oral arguments will be heard at Washington about Sept. 15 and a final decision in the case is expected about the first of October.

Mr. Ahearn, who spoke not only for the National Sand & Gravel Assn. but also for the Mississippi Sand & Gravel Assn., the Northeastern Ohio Sand & Gravel Assn., the Indiana Sand & Gravel Assn., the Illinois Sand & Gravel Assn., the Michigan Sand & Gravel Assn., the Ohio Sand & Gravel Producers' Assn., the Missouri Valley Sand & Gravel Assn., and the Texas Crushed Stone, Sand & Gravel Assn., said in part:

"The National Sand & Gravel Assn. has 150 active members and 65 associate members, and a careful study shows that its membership includes approximately 65 per cent. of the total sand-and-gravel production of the United States. . . . While records of the U. S. Bureau of Mines show that there are more than 1,500 sand-and-gravel companies in this country, an analysis made by the bureau brought out that fewer than 2 per cent. of the producers were responsible for 33 per cent. of the total production; conversely 51 per cent. of the producers in the lower bracket had a total output of less than 4 per cent. of the total production. . . .

"Sand and gravel are basic building materials. There is no construction project which does not require the use of one of or both these materials, from the lowest type of improved road to the finished cement-concrete pavement and from the humblest home to the most majestic office building or railroad terminal. Some idea of the importance of the sand-and-gravel industry as a user of railroad facilities may be gained from learning that its product ranks fourth in volume among the commodities handled by the carriers, being exceeded only by bituminous coal, anthracite coal, and iron ore. The average loading per car in 1929 was 53.87 tons, compared

with an average of 52.74 tons in 1928. This average is 2.18 tons greater than the average loading of all products of mines, which is 51.69 tons. Sand-and-gravel shipments rank ninth from the standpoint of the revenue which they bring to the railroads, its superiors on the list being, in most cases, commodities which do not load as heavily in the car and which move for much longer distances. Sand and gravel are essentially short-haul commodities. . . .

"The sand-and-gravel industry has had a remarkable growth in the comparatively few years of its official existence. Reports of the U. S. Bureau of Mines show that it has developed from an annual production in 1902 of 1,847,901 tons, valued at $1,423,614, to the record figure of 222,571,905 tons, valued at $132,835,979, in 1929, the last year for which final reports are available. The average price of sand and gravel reached its highest point of 80 c. per ton in 1920. Since then it has declined for obvious causes. In 1929 the average price was 59 c. per ton, including the so-called higher-grade and higher-priced sands, such as glass and molding sand. The National Sand & Gravel Assn. represents only producers of building and ballast sand and gravel, the average price of which, particularly in 1931, is considerably less than 59 c. a ton.

"My first exhibit (Table I) contains data of production and railroad transportation of sand, gravel and crushed stone, in various periods of recent years. The first three columns show sand-and-gravel production from 1917 to 1929, inclusive, crushed-stone production during the same period, and the combined total production of these commodities during the years in question. The data were obtained from reports of the U. S. Geological Survey and the U. S. Bureau of Mines.

"Column seven shows the revenue tons of clay, gravel, sand and stone originated by Class I carriers in the same period. . . . Beginning with 1928, the Interstate Commerce Commission revised its classification of commodities handled by the railroads. Gravel and sand (other than glass or molding) was given one classification, crushed stone another, and clay was placed in the miscellaneous grouping. For 1928, 1929, and 1930, in order to make our comparisons as consistent as possible, we have secured our totals (columns eight and nine) by adding the revenue tons originated of sand and gravel to those of crushed stone, making no allowance for clay, since it is now impossible to determine the volume of that movement. It seems reasonable enough, however, to suggest that it is relatively limited in extent and that it is not an important factor in our calculation. . . . Sand-and-gravel production increased from 209,118,868 tons in 1928 to 222,571,905 tons in 1929, an increase of 6 per cent.; yet the revenue tons originated by the carriers declined in that period from 85,667,157 tons to 81,408,069 tons, a decrease of 5 per cent. The carriers, therefore, not only secured no additional business from the increased production in 1929, but actually lost ground. The revenue tons originated in 1930 sustained a further decline to 73,983,884 tons, a decrease of 9 per cent. compared with 1929 and a decrease of 14 per cent. compared with the 1928 total.

"The fifth column shows sand, gravel and crushed-stone production from 1917 to 1929 inclusive, expressed as percentages of 1917. The sixth column shows the revenue tons originated by the carriers of clay, gravel, sand and stone (with modifications for 1928, 1929, and 1930 previously explained), also expressed as percentages of 1917. The 1929 comparison shows that the production of these materials increased 170 per cent. while the railroad volume increased but 12 per cent. If we stop our studies at 1927, the last year in which the commission used its 'clay, gravel, sand and stone' grouping, we find that the production of sand, gravel and crushed stone increased 150 per cent. while the revenue tons originated by the carriers increased but 57.9 per cent. These data show conclusively that railroad sand, gravel and crushed-stone traffic has failed to keep step with the increases in production of these materials, and that other means

TABLE I.—PRODUCTION AND SHIPMENTS OF SAND AND GRAVEL, CRUSHED STONE, AND CLAY

Year	Production of Sand, Gravel and Crushed Stone (*tons*)			Sand, Gravel and Stone Production Handled by Railroads (*per cent.*)[1]	Production of Sand, Gravel and Crushed Stone (1917-100.0)	Revenue Tons Originated by Class I Carriers (Clay, Gravel, Sand and Stone)[2] (1917-100.0)	Revenue Tons Originated by Class I Carriers (Clay, Gravel, Sand and Stone)[3]	Total Production of Sand and Gravel[4] (*tons*)	Revenue Tons Originated by Class I Carriers of Gravel and Sand (other than Glass or Molding)[3]
	Sand and Gravel	Crushed Stone	Total						
1917	76,419,325	40,285,377	116,704,702	.....	100.0	100.0	102,481,443	.....	.....
1918	61,824,426	29,373,342	91,197,768	.....	78.2	86.7	88,819,202	.....	.....
1919	70,576,407	33,673,339	104,249,746	.....	89.3	84.8	86,930,435	.....	.....
1920	82,041,388	40,365,860	122,407,248	.....	104.8	96.3	98,720,294	.....	.....
1921	79,845,008	43,202,840	123,047,848	50.8	105.4	86.2	88,311,523	.....	.....
1922	94,867,046	49,763,740	144,630,786	[6]	123.9	100.5	102,933,054	.....	.....
1923	139,932,153	62,322,710	202,254,863	51.7	173.2	130.7	133,933,710	.....	.....
1924	156,230,063	68,198,440	224,428,503	42.7	192.2	133.4	136,649,619	.....	.....
1925	172,001,473	75,672,930	247,674,403	40.4	212.2	141.9	145,402,178	.....	.....
1926	183,100,818	82,515,560	265,616,378	49.3	227.5	153.5	157,295,962	.....	.....
1927	197,454,269	94,948,770	292,403,039	46.9	250.5	157.9	161,782,141	.....	.....
1928	209,118,868	91,265,360	300,384,228	44.6	257.3	[6]118.2	[3]121,133,616	209,118,868	85,667,157
1929	222,571,905	92,721,260	315,293,165	41.1	270.1	[6]112.2	[3]114,937,147	222,571,905	81,408,069
1930	[5]	[5]	[5]	.....	[5]	[6]103.2	[3]105,810,069	[5]	73,983,884

[1]Car-loadings reduced to tonnage by assuming average load over years to be 50 tons per car.
[2]"Clay, gravel, sand and stone" (commodity description 35, I. C. C. Reports) include: Brick dust, cherts, china clay, clay, crushed stone, dolomite, earth (N. O. I.B.N. and infusorial), emery, fire-clay, Fuller's earth, ganister, granite, gravel, grout, gypsum (crude and powdered), jasper stone, kadin, limestone, loam, magnesite, marble (including chips, dust and slabs), molders' sand, mud (rumbler), onyx, pebbles, pipe-clay, riprap, rubble stone, sand, shale, silica, slate, soapstone, spar, stone (N.O.I.B.N. and crushed), stone curbing, stone facing, stone flagging, stone paving-blocks, stone screenings, stone slabs, talc.
[3]Data from I. C. C. freight-commodity statistics.
[4]Data from U. S. Bureau of Mines.
[5]Data not available.
[6]Data not completed by American Railway Assn.

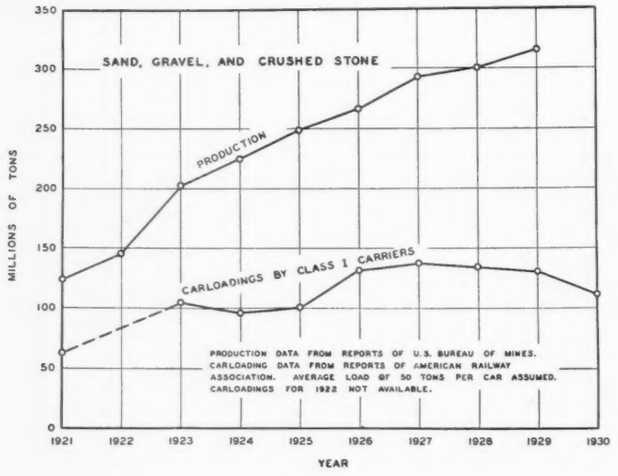


Fig. 1.

of transportation are being used in increasing proportions.

"The fourth column affords additional understanding of the trend away from the railroad as a means of transporting sand, gravel and crushed stone. It shows the percentage of total sand, gravel and stone production handled each year by the railroads during this period. . . . In 1921, as the exhibit shows, the carriers handled 50.8 per cent. of the total production of sand, gravel and stone; in 1929 this had declined to 41.1 per cent.

"Our second exhibit (Fig. 1) is a chart based upon the data given in column four of Table I. It presents a graphic portrayal of how the sand-and-gravel industry is being compelled by economic forces to use other means of transportation than the railroads. We call particular attention to the width of the gap between the two curves in 1929 as compared with 1921."

Extracts from a digest, prepared by Mr. Ahearn, of answers to six questions regarding the proposed rate increase follow:

Question 1.—Would the proposed increase of 15 per cent. in sand-and-gravel rates result in diverting existing railroad sand-and-gravel business to other methods of transportation?

Question 2.—If the answer to Question 1 is in the affirmative, would the established producers in your locality lose the business to wayside-pit operations?

(Note: These two questions are grouped because most of the respondents to the questionnaire grouped their answers.)

"We firmly believe that a 15-per cent. increase in sand-and-gravel rates will divert business from the railroads to water and truck transportation and, consequently, that the established producers in our locality will continue to lose more business to wayside pits and plants which ship by boat."—Grand Rapids Gravel Co., Grand Rapids, Mich.

"We do not believe a proposed 15-per cent. increase in sand-and-gravel rates would divert existing railroad shipments to other methods of transportation for the immediate Pittsburgh producers. For the bank- and crushed-gravel producers, however, located away from the rivers and with whom we compete in the outlying districts, we believe more of their output would be delivered by trucks if there were an increase in freight rates. We believe, should rates be increased, that some business we are now getting would go to bank and crushed producers, as the higher freight rates would enable them to extend their trucking radius. Also, if rates are increased, we believe we would lose business to slag operations which market their product mostly by truck."—Sand & Gravel Co., Pittsburgh, Pa.

"If the increase of 15 per cent. asked by the railroads, were uniformly applied to short- and long-haul rates, it would undoubtedly have the effect of diverting further business from railroad to truck transportation."—Stewart Sand & Material Co., Kansas City, Mo.

"Increasing sand-and-gravel rates would divert business from the railroads. Established producers have lost at least 50 per cent. of their car-load business in this district because of the wayside-pit development."—J. L. Shiely Co., St. Paul, Minn.

"We believe an increase of 15 per cent. in sand-and-gravel rates would result in diverting traffic from railroads serving our plants. As it is, with existing rates, traffic is gradually leaving the railroads and going to trucks. The average truck haul is lengthening each year and, if higher rates are put in effect, local operators will start in some parts of our territory which would shut out that part of our market now served by railroad."—Eastern Rock Products, Inc., Utica, N. Y.

"An increase of 15 per cent. in rates would cause the railroads to lose business in our territory, particularly in Pennsylvania, which has adopted a program of low-cost roads, advocating the use of native material when it can be found."—Buffalo Slag Co., Buffalo, N. Y.

"Sand and gravel in this territory are sometimes delivered to the job by truck direct from wayside operations, also by barge from river operations to the river bank at point nearest the work. The proposed 15-per cent. increase in freight rates will naturally tend to increase this class of movement."—Montgomery Gravel Co., Montgomery, Ala.

"An increase in sand-and-gravel rates would result in an added loss of business to the carriers by increasing the use of the motor truck in the transportation of our commodity and in the opening of additional wayside pits. To date during 1931, 60 per cent. of the potential business has been lost to local, wayside pits. If this is true under the existing freight-rate structure, what will be the result under increased freight rates? The freight rate is the controlling factor, as fully 60 per cent. of the actual cost of application of gravel in secondary-road construction is that of the freight paid on transportation of the material from the point of production to the unloading destination."—Western Sand & Gravel Co., Spring Valley, Ill.

"An increase of 15 per cent. in sand-and-gravel rates in our territory would beyond any doubt result in diverting a very appreciable amount of business now handled by the railroads to truck shipments. The proposed increase would add a very strong impetus to the opening of more wayside pits than are now in existence and would add substantially to the volume of business those now in existence are able to take from the established producers."—Marion Sand & Gravel Co., Marion, O.

"An increase in sand-and-gravel rates would divert railroad business to the trucks by permitting the further substitution of stone from local quarries. The major portion of the business would be lost by the established producers who ship by rail."—St. Louis Material & Supply Co., St. Louis, Mo.

"Any advance in railroad rates applying on sand and gravel naturally would extend the territory to which deliveries may be made by trucks or water. In many instances the business would be lost to wayside-pit operations, while in other cases truck deliveries would be made from the plants of the established producers, practically all of whom have been forced to establish truck-loading facilities. In either event the railroads would lose the movement."—Neal Gravel Co., Mattoon, Ill.

"The proposed increase, in our judgment, would further divert a large volume of tonnage of sand and gravel to other methods of transportation. The carriers are now losing from 500,000 to 750,000 tons yearly to wayside pits in about fifteen counties alone around Peoria, Ill. A rate increase would naturally have the effect of driving more tonnage to wayside-pit operations."—McGrath Sand & Gravel Co., Lincoln, Ill.

Question 3.—Has the existing basis of sand-and-gravel rates in your territory resulted in the established plants losing business to wayside-pit operations which, under a

more reasonable rate structure, would have been supplied by the established producers?

"In Kansas the tendency has been to disperse the production of sand and gravel by creating a large number of plants serving smaller territories where the freight rates are favorable, thereby reducing the average revenue per car to the railroads."—Stewart Sand & Material Co., Kansas City, Mo.

"Existing rates have denied us some business. Where trucking only has been involved, we have lost a substantial amount of business because we could not compete."—Eastern Rock Products, Inc., Utica, N. Y.

"A more reasonable rate structure would have tended toward business being more confined to established producers shipping by railroad. There would always have been wayside-pit competition, but there would not have resulted this astounding increase, depriving established producers of the tonnage and the railroads of revenue."—Western Sand & Gravel Co., Spring Valley, Ill.

"Existing rates in this territory have resulted in a big loss of tonnage to the established plants shipping by rail."—Wyoming Sand & Stone Co., Wilkes-Barre, Pa.

"The present level of sand-and-gravel rates in our opinion is too high. Negotiations with the carriers to reduce present rates have been in progress for some time, but without results."—St. Louis Material & Supply Co., St. Louis, Mo.

"Existing rates are too high. With a rate of 50 c. per ton in our first bracket, all the gravel used in the McLennan County program for surfacing lateral roads, 300 mi. of which have been completed, has been got from the wayside pits, and there is no chance of our shipping the material for the remaining 200 mi. now under contract. With a rate of 26 c. per ton in the first bracket during 1914, 1915, and 1916, the established producers shipped by rail all the gravel used in a similar program."—Potts-Moore Gravel Co., Waco, Tex.

"The existing basis of rates has multiplied the number of plants, automatically requiring a greater service on the part of the carriers to serve the increased number of plants without any increase at all in tonnage."—Price Sand Co., Tulsa, Okla.

"We have lost thousands of tons in our territory to wayside-pit operations on account of the present rate structure. The carriers' loss has been even greater, because approximately 40,000 tons will be trucked from our Chillicothe plant this year and another 40,000 tons will be trucked from our plant at Pekin. This material is being trucked as far as 25 mi. from the various plants. A reasonable reduction in the present rates would hold a large part of this tonnage for railroad delivery. We discourage truck transportation whenever it is possible to do so."—McGrath Sand & Gravel Co., Lincoln, Ill.

Question 4.—Speaking generally, does your company believe that an increase of 15 per cent. in sand-and-gravel rates would produce actual additional revenue for the railroads?

The answers to this question were emphatically in the negative. As already stated, only three out of 47 companies thought that the carriers would secure additional revenue from increasing sand-and-gravel rates. On the contrary, 44 representative producing companies in various parts of the country insisted that, instead of securing actual additional revenue from increased rates, the carriers would suffer a decline in revenue.

"As far as the New England territory is concerned, we believe that an increase of 15 per cent. in sand-and-gravel rates would produce less actual revenue for the railroads. On the assumption that the average freight rate per ton is approximately $1 on the existing basis in our territory, an increase of 15 c. will allow wayside-pit operations to haul their material by truck 3 or 4 mi. farther in competition with sand and gravel handled by railroad."—Boston Sand & Gravel Co., Boston, Mass.

"We do not believe a 15-per cent. increase in rates on sand and gravel in this territory will increase the gross or net revenue to the carriers, as such an increase will tend to reduce greatly, and possibly eliminate, all long-haul shipments from the regularly-established operations, diverting the business to wayside pits for movement by trucks. Business is being lost in this territory to this class of operation by the regularly-established operations under the present scale of freight rates, and a 15-per cent. increase will most certainly divert more business from the long-haul shipper to local wayside operations. An increase of 15 per cent. will even raise the short-haul rates to such an extent that it will be more economical to haul direct from operations to the work."—Montgomery Gravel Co., Montgomery, Ala.

Question 5.—Does the existing rate structure on sand and gravel have the effect of so diverting business from the established sand-and-gravel plants to the wayside-pit operations as to make your operations unprofitable even in years of normal demand? In other words, do you believe that the sand-and-gravel industry in general is faced, in proportion, with as important financial problems as the railroads?

The following are cited as typical replies to Question No. 5:

"Wayside-pit operations and water competition are making serious inroads in our market and causing our operations to become more unprofitable from year to year. If the 15-per cent. increase is granted to the railroads, this form of competition will increase, and we will eventually be forced to abandon our plants and discontinue operations."

"At the present time the operation of the regularly-established sand-and-gravel plant is unprofitable due to its being necessary to name extremely low prices to meet competition from local or wayside operations, which are opened as rapidly as major projects are started. We believe that a 15-per cent. increase in freight rates will greatly curtail shipments from the regularly-established operations, which shipments are long-haul movements in a majority of cases, and it is highly probable that these long-haul shippers will have even greater difficulty in continuing to operate in this territory if such increase is made."

"The sand-and-gravel industry, in general, is faced, in our opinion, with worse financial difficulties than the railroads. For, in addition to having a very low demand, prices on sand and gravel are down to a pre-war basis without any possible relief through regulation. On the other hand, the railroads can maintain their present rates, and while it may be admitted that their tonnage is much below normal, their selling prices or charges for the service rendered at least can be constant."

"Upon our present rate of production, due entirely to the competition of the wayside pit, our operation is highly unprofitable, and we look forward with fear and uncertainty as to operations in the future. The only solution may be that this company will enter the wayside-pit field. Speaking as one unit of the sand-and-gravel industry, we are faced with as important financial problems as the railroads."

"We believe that the sand-and-gravel industry is faced with as important financial problems as the railroads. The plight of the industry, particularly in competition with local quarries and local pits, has reached a point that even under normal conditions we would find it in many instances impossible to compete. Very often the freight revenue is as much as twice the amount of the realized price at the plant."

Question 6.—During the period from 1920 to 1930, what have been the trends in your company's shipments and in your territory with reference to methods of transporting sand and gravel to the job? In other words, has the percentage of movements by railroad been declining in favor of truck or water transportation? And would an increase have the effect of stimulating the use of such other transportation than the railroad?

This question received the same answer from all respondents. During the period from 1920 to 1930 there has been a decided trend away from railroad transportation of sand and gravel in favor of truck and water movement, to the disadvantage of the carriers' revenues and to the disadvantage of the established producers of sand and gravel. This steady decline in railroad car-loadings is attributed to the cheaper transportation cost offered by the trucks and boats, and the opinion is universally held by sand-and-gravel producers that any increase in freight rates on sand and gravel will result in the further replacement of the railroad as a means of transporting sand and gravel.

It will be of interest to cite a few typical replies to Question No. 6:

"During the period 1920-30 there has been a decided trend toward trucking of our products. Movement by truck has denied the railroad a substantial amount of that business. An increase in freight rates will stimulate trucking competition. Trucking, and combined truck-and-water transportation, will be more profitable and efficient because of greater profits and longer hauls if increased rates are allowed."—Eastern Rock Products, Inc., Utica, N. Y.

"Materials trucked from our plants up to a maximum haul of 12 mi. have increased from a minimum in 1921 of 4 per cent. of total sales to a maximum in 1928-29 of 18.7 per cent. of total sales. Had the rates been such that this sand could have continued to move by rail on the basis of the percentage moved in 1921, then approximately 7,900 cars of freight would have been moved by the carriers in 11 yr. which was actually moved by truck. This movement would have added about $200,000 to the total revenue of the carriers, or an average of $18,000 per year."—Stewart Sand & Material Co., Kansas City, Mo.

"During the period from 1920 to 1930 there has been a very marked trend in the company's shipments toward the movement of sand and gravel by trucks and water transportation. Any further increases in railroad rates would unquestionably have the effect of increasing the use of other means of transportation than the railway."—American Aggregates Corp., Greenville, O.

"There has been a heavy decrease in the shipments of our company due to the fact that wayside-pit, water and truck competition have cut heavily into our tonnage. While it is impossible to furnish exact figures, a loss of 25 per cent. in tonnage due to water and truck competition is conservative. If there should be an advance in freight rates, we believe an additional loss of 50 per cent. of our present tonnage would follow, as much of our market lies between the Detroit River and our pit. The higher the rates, the farther material could be handled back from the river into the country toward our operations."—Ward Sand & Gravel Co., Oxford, Mich.

"Since the first part of 1929 the trucking companies have been hauling materials from various wayside pits to various destinations in far greater proportion than it was possible to conceive. If an increase in sand-gravel rates is allowed, then we shall, without question, lose a larger amount of business to these various pits."—Standard Building Materials Co., St. Louis, Mo.

The fourth exhibit was a digest prepared by Mr. Ahearn of answers to five questions submitted to the association's membership for the purpose of developing information with respect to recent voluntary rate reductions by the railroads on sand-and-gravel movements. They show a long list of references to recent tariffs in which voluntary rate reductions have been made. There were other reductions concerning which member companies were unable to supply tariff reference. They were made for the purpose of securing the traffic for the railroads in instances where it was clear that, if the reductions were not made, the railroads would lose the business. Answers to the questionnaire showed a number of noteworthy instances in which railroad tonnages of sand and gravel increased in substantial measure after the rate reductions. These facts led the association to the conclusion that an increase in the rates which have been reduced would be reversing a sound policy and would restore the rates to a level which would prohibit railroad movement. It appears further to the association to be a sound conclusion that a substantial increase in sand-and-gravel rates which have not been reduced will result in a diminished volume of railroad traffic.

"We believe that it is possible for the railroads of the United States to derive more revenue than they now secure from the transportation of sand and gravel," continued Mr. Ahearn, "but we are firmly convinced, and we have data to support our position, that such increase in revenue will not be obtained by a general increase in rates on our traffic. There are numerous instances where railroad traffic officials have voluntarily reduced rates on sand and gravel because the higher rates, authorized for the most part by the Interstate Commerce Commission, would not permit the flow of traffic and were diverting railroad sand-and-gravel business to truck and water transportation. With the reduction in rates which placed the established sand-and-gravel producer in a position to compete by rail with wayside pits and temporary operations, there came a decided increase in sand-and-gravel volume by railroad in the specific cases in question.

"Under these circumstances we believe that it would be very unwise to impose arbitrarily a percentage increase in sand-and-gravel rates for universal application throughout the country. Our members are of the opinion that, if the adjustment of sand-and-gravel rates to meet local conditions could be decentralized by providing for conferences of railroad traffic officials and interested groups of sand-and-gravel producers, out of these conferences would come a measure of rates which would not only enable the railroads to check the trend away from the railroads as a sand-and-gravel transportation medium, but actually to increase the revenue which they are receiving from our materials at the present time.

"We feel that we have a common interest with the railroads in stemming the drift toward the substitution of the wayside pit for the established sand-and-gravel plant as a source of sand-and-gravel supply. The established plant depends in an overwhelming percentage upon the railroad; the wayside pit does not contribute one pound of sand and gravel to the revenues of the carriers. Therefore, our members are as anxious as the railroads that they should derive more revenue from sand-and-gravel transportation, for if high freight charges encourage the development of local sand-and-gravel operations to take care of the public and private building program, including highways, structures, and other improvements, we and the railroads as well suffer a financial loss.

"Any proposal for an increase in freight rates, which has as its objective the production of greater revenue for the carriers, embodies the assumption that higher rates would not disturb the existing flow of traffic. In the case of sand and gravel such an assumption is fallacious. Our transportation characteristics furnish clear proof that additional increases in rates will injure rather than benefit the revenues derived by the carriers from hauling sand and gravel. There is evidence that the carriers themselves recognize this fact, as the following quotation from their petition to the commission will demonstrate: 'It is probable that short-haul traffic should be treated somewhat as a by-product and that for the shorter distances the rate should be relatively lower and for the longer distances,

(*Continued on page 52*)

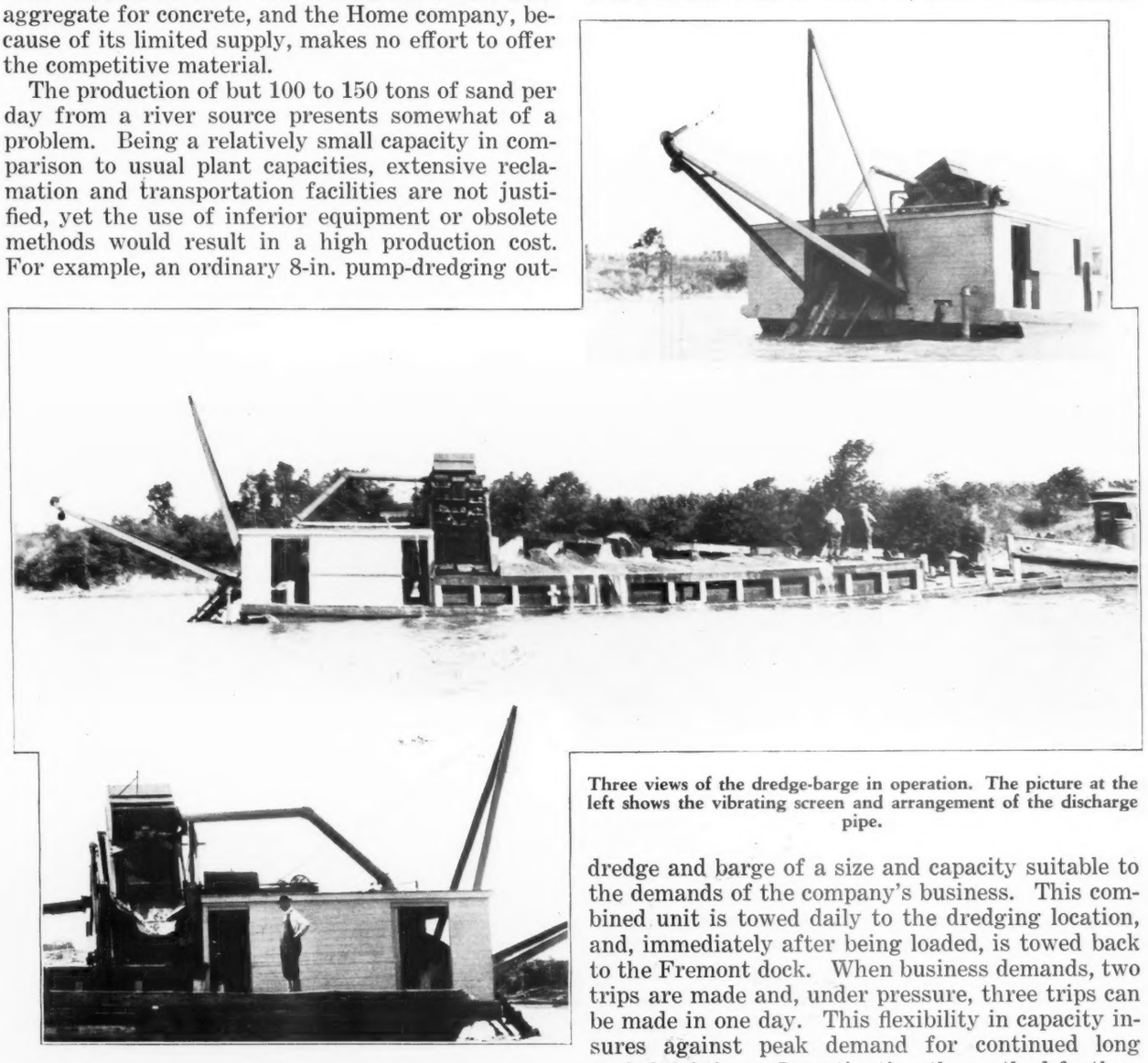
River Aggregates Produced Economically by Combined Dredge and Barge

Gravel Raised from Stream Bed Processed and Transported to Shore by Same Vessel

FOR the small-tonnage aggregate producer no better example of efficient river-reclamation equipment can be found than at Fremont, O. Here the Home Sand & Coal Co. supplies local needs for sand, there being little or no gravel in its source of supply—the Sandusky River. In this part of Ohio crushed stone is well established as a coarse aggregate for concrete, and the Home company, because of its limited supply, makes no effort to offer the competitive material.

The production of but 100 to 150 tons of sand per day from a river source presents somewhat of a problem. Being a relatively small capacity in comparison to usual plant capacities, extensive reclamation and transportation facilities are not justified, yet the use of inferior equipment or obsolete methods would result in a high production cost. For example, an ordinary 8-in. pump-dredging outfit can easily recover and load 150 tons of sand in 2 hr. or less. In this instance, the dredge is located some distance from the plant, so a barge and a tow-boat are necessary to transport the sand to the dock. With this equipment, in addition to the dredge crew, it would be necessary to have a night watchman aboard the dredge and a tow-boat engineer. Considering that the plant is, productively speaking, idle for 22 hr. per day the investment and pay-roll are obviously too large for so small a tonnage.

In solving this problem Geo. Brokate, president of the Home Sand & Coal Co., uses a combination dredge and barge of a size and capacity suitable to the demands of the company's business. This combined unit is towed daily to the dredging location, and, immediately after being loaded, is towed back to the Fremont dock. When business demands, two trips are made and, under pressure, three trips can be made in one day. This flexibility in capacity insures against peak demand for continued long periods of time. Investigating the method further, it will be found that the tow-boat engineer is also an experienced dredge operator, and that the crew divides its time between manning the dredge, loading sand, unloading at the dock, and general yard duties. Thus, a crew of five men handles the entire



Three views of the dredge-barge in operation. The picture at the left shows the vibrating screen and arrangement of the discharge pipe.

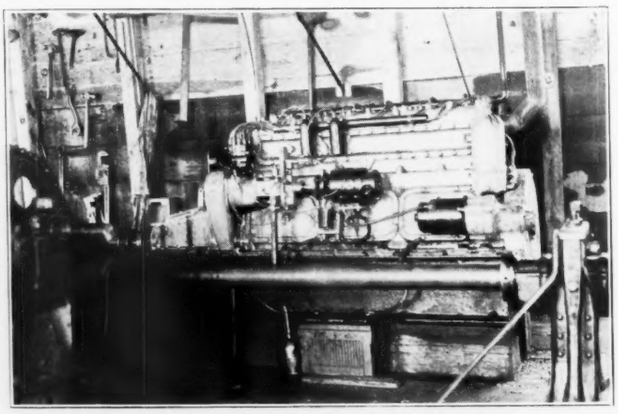
The dredge-barge as seen from the rear with tug-boat "Reliance" alongside.

operation and, because of their diversified duties, little time is wasted. Then, too, the equipment comprises only two units with a relatively small investment involved.

Originally the Home company operated a steam-powered combination dredge and barge. This was replaced during the winter of 1930-1931 with a rebuilt barge equipped with a modern gasoline-engine power-plant. The complete dredging equipment is on a par with the best in the dredging field. Essentially the barge-and-dredge unit consists of a 24-ft. by 88-ft. hull of timber construction. It has an overall draft of 5 ft. 10 in., and there are four inbuilt bulkheads. A space of 24 ft. square at one end of the barge is allotted to the dredging machinery and is inclosed by a cabin. Directly behind it, the sand compartment extends for a length of 40 ft., storing 130 tons of material when loaded to its capacity. Three wells on each side-wall allow the excess water to drain overboard.

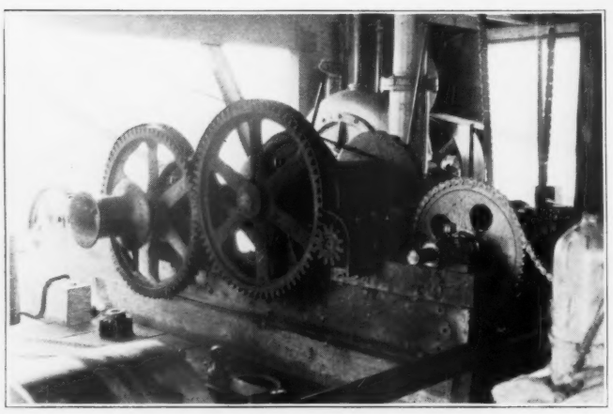
The principal part of the dredging equipment is the Morris 8-in. sand pump and its gasoline-engine drive, arranged in a manner which affords simplicity in power transmission and, at the same time, fairly good weight distribution. Directly in the front of the center of the compartment the pump suction pipe, with its nozzle ladder, extends outward, supported by an A-frame made of 8-in. channel-iron sections. Immediately adjacent to the nozzle ladder at the latter's hinge-point the Morris pump is mounted. It is connected to the suction pipe by a long-sweep L and a flexible rubber coupling hose. This position shortens the length of the suction line and is convenient to the driving mechanism.

In the center of the machinery compartment is located a Byers 2-drum hoist for the manipulation of the nozzle ladder. One drum of the hoist raises or lowers the nozzle ladder through a ¾-in. wire-rope tackle. The forward drum of the hoist acts as a pulley; it is connected by a short-centered belt to the nozzle-ladder chain, which it operates at a speed



A 150-hp. gasoline engine on the dredge supplies all power requirements.

of 30 ft. per min. Toward the left rear side of the machinery compartment the gasoline engine is mounted. This unit is a 6-cylinder, twin-ignition Sterling-Petrel engine which has a rated horsepower of 150 at 2,000 r.p.m. Power is distributed from the engine to the various mechanical units by a jackshaft which is mounted transversely on the barge between the engine and the hoist. A Dayton 14-belt cog-belt drive transmits the power to the jackshaft, which drives the pump (through a clutch and a belt drive) and the hoist (through a chain drive). With the dredging machinery there is also



The hoist with jack-shaft in foreground.

a Goulds 5-in. centrifugal pump which furnishes water to the sand-sluiceway jet. For bilge-pumping and priming the Morris pump a 2-in. Viking gasoline-engine-driven pump is provided.

Following the flow of materials, the nozzle ladder, which has a working depth of 26 ft., is manipulated in the river bottom for the sand. The pump delivers the material directly upward through the cabin roof, and thence horizontally to a steel distribution box mounted over a Leahy vibrating screen, which is used to screen out trash and oversize material in the form of small shells, gravel and the like. A second deck on the screen provides for the separation of coarse and fine sand, which is sent to a sand drag. Here three bucket-elevators drag the sand from the tank and discharge it to a sluiceway where it is washed out by a wood flume leading to the barge compartment. Through the use and

Locomotive crane for unloading barge to stock-piles.

arrangement of the vibrating screen and sand-drag, considerable space is saved to the advantage of sand-carrying capacity. The screen is mounted above the level of the cabin roof at right angles to the barge so that its "rejects" fall directly to the river without chutes. Directly beneath the screen and extending to the other side of the barge is the sand-drag. This is located so that its overflow is discharged to the river directly opposite the discharge of the screen "rejects." The extreme width of the tank and the vibrating screen overhead is not

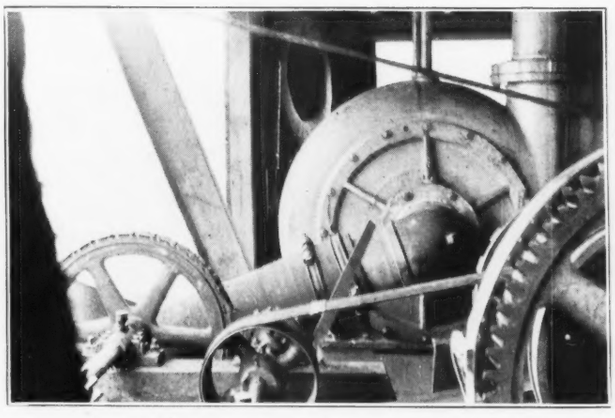
Truck-loading bins with stock-piles in background.

greater than 6 ft., which is within the 24-ft. machinery-compartment measurement.

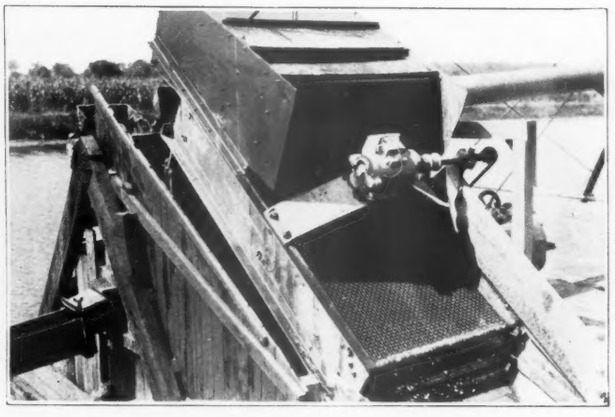
The Leahy screen, a Deister Concentrator Co. product, is a 4-ft. by 7-ft. double-deck unit operated through a chain drive from the jackshaft in the machinery compartment. It is equipped with a ¾-in.-mesh wire-cloth screen panel on the upper deck which acts as a scalper and either ⅜-in.- or ¼-in.-mesh cloth on the lower deck, depending upon the size of sand desired. The screen cloth was furnished by the Deister company. In the sand tank, three Link-Belt chain bucket-elevators, mounted on common head-and-tail shafts, are employed for the drag. Drilled 8-in. by 18-in. buckets dewater the sand, and their staggered mounting on the chains provides a fairly even flow to the sluiceway. The elevators are 14-ft. long between centers, and are driven together from a common headshaft connected to the jackshaft.

Sand from the sluiceway is flumed to the barge compartment, aided by a jet of water introduced beneath the bucket discharge. Small slides in the flume allow control of the distribution of the sand, and the entire flume is demountable for unloading when the barge arrives at the Fremont dock.

Under normal conditions, 2 hr. is required to load the 130-ton sand compartment. A tow-boat, *The Reliance*, a tug driven by an Atlas Diesel engine, tows the dredge-barge to and from the Fremont



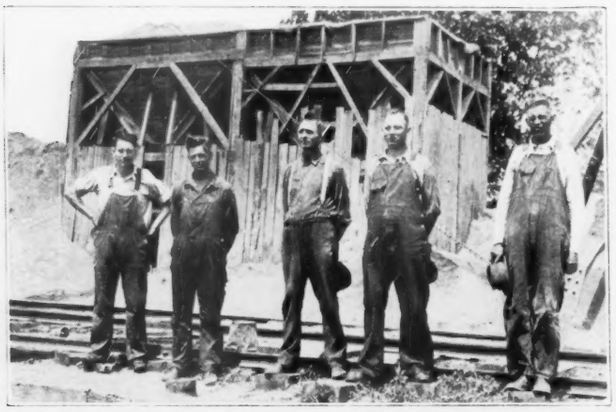
The dredge pump and ladder-chain sprocket at left.



Vibrating screen for scalping and classifying.

dock, making the round trip, including the time for dredging, in approximately 6 hr.

Facilities at the Home Sand & Coal Co. dock are in keeping with its business requirements, adequate for convenient and efficient handling of its mate-



The operating force, with George Brokate, head of the company, third from the left.

rials. Along the river front is a timber-and-concrete dock to which the marine equipment is tied and along which a railroad track, with connections to Fremont railroad facilities, extends. From this track a Browning locomotive-crane, equipped with a 1¼-cu.yd. Owen bucket, is operated. With this unit, the derrick-barge is unloaded, the material being dumped to stock-piles which extend along the track. Two piles store concrete and masons' sand to the extent of 10,000 tons. There is also a 2-compartment wooden hopper for the loading of trucks. Railroad cars can be loaded by the Browning crane from the track direct, from the derrick-barge, or from the stock-piles.

Attacks Plan to Raise Rates

(*Continued from page 48*)

where the motor-truck competition is not effective, they should be relatively higher.' The sand-and-gravel industry's case is aptly expressed in these words.

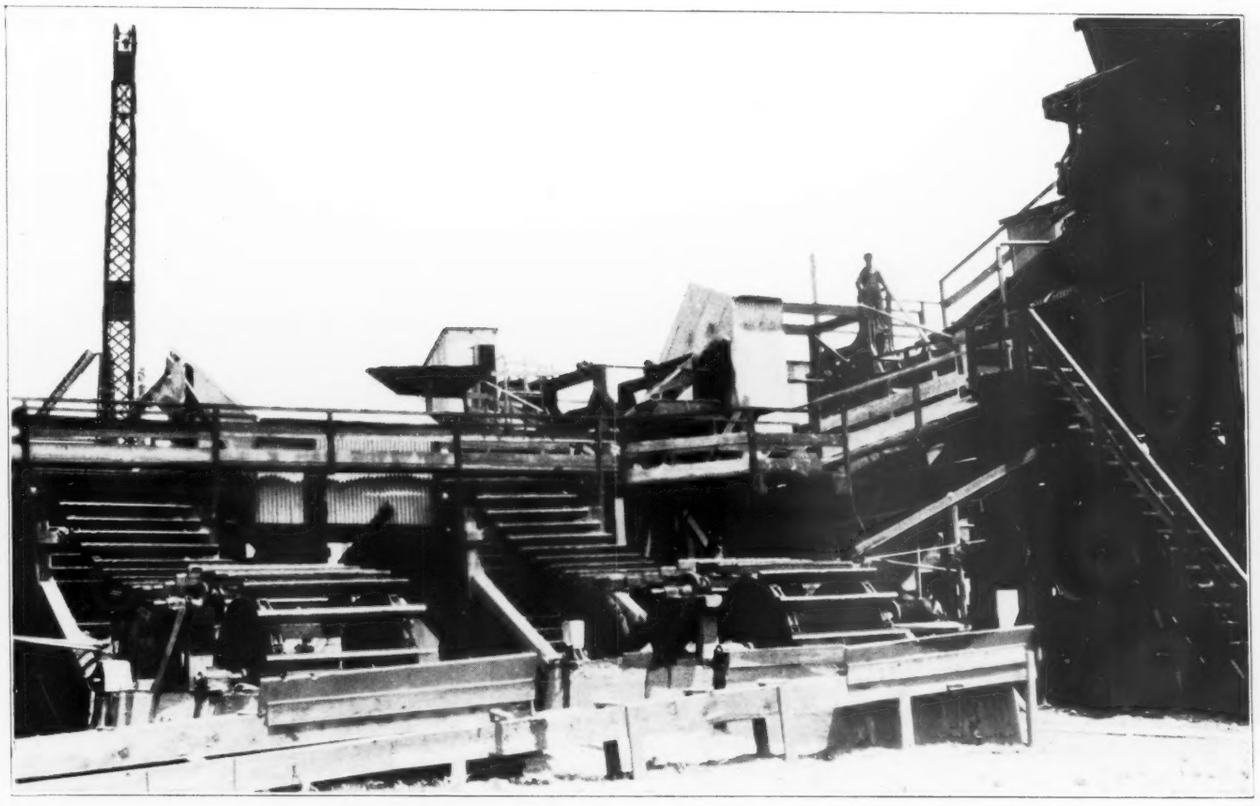
"As the carriers pointed out further in their petition, it has been their practice heretofore to make rates relatively higher for short distances because the terminal expenses are constant and the longer hauls tend to absorb them, but the inflexibility in rate-making to which they have permitted this theory to lead them has resulted in a declining volume of sand-and-gravel business in the face of a mounting sand-and-gravel production curve reported by the U. S. Bureau of Mines. The National Sand & Gravel Assn. in previous proceedings before the commission, together with local groups of producers in rate investigations confined to limited areas, has been consistent in urging the carriers not to maintain their rates on such short-haul business as sand and gravel at a point where the movement of these materials will be defeated by economic forces. In the main that warning went unheeded, and the results are conclusive of the justification of our position.

"In every instance the delivered price of sand and gravel comprises a greater percentage of transportation charges than it does the price at the plant, for our materials, of heavy-loading and low-value characteristics, have a limited shipping radius. Sand and gravel are highly sensitive, therefore, to even the slightest increase in rates, more so than any commodity offered to the railroads for transportation. It was brought out in a statement submitted to the commission by the Security Owners' Assn. in this case that to grant a 15-per cent. increase in sand-and-gravel rates would amount to only 13 c. a ton. The inference was, apparently, that 13 c. a ton is of comparatively small significance. We do not know how they arrived at this figure, but we are confident the owners of railroad securities would be considerably surprised to learn what a violent readjustment in sand-and-gravel transportation by railroads would result from an average increase of 13 c. per ton in rates, not to mention how great a percentage of the average sand-and-gravel price at the plant to-day 13 c. would represent. The substantial decline in sand-and-gravel shipments over the railroads in recent years has been due to cheaper transportation by truck and by water, and the radius of effective competition from these sources will be widened if the present basis of sand-and-gravel rates is further increased, to the disadvantage of the railroads and to the disadvantage of the established sand-and-gravel industry.

"At the special meeting of our membership held in St. Louis on July 31, emphatic approval was given to the following paragraph from the report by the committee appointed at the meeting to recommend the policy which should guide the association in this case:

"'This committee is of the opinion, in the event of an authorized increase in sand-and-gravel rates, that such increase should be expressed in flat cents per ton rather than by percentage increase, to the end that present competitive relationships, in many cases approved by the Interstate Commerce Commission and by state commissions, may be preserved and maintained.'

"Our members, in discussing the possibility of an increase in freight rates on sand and gravel, emphasized the fact that a revenue case before the commission is not the same as a strictly rate case. It is, of course, obvious that a percentage increase in freight rates would change and disturb existing competitive relationships. If there are any competitive relationships at the present time which are wrong and should be corrected, it was the feeling of our member companies that a revenue case is not the place to institute a new basis. On the other hand, if existing competitive relationships are right, a revenue case should not be permitted to be the means of disrupting them. We respectfully urge your commission, if any increase in freight rates on sand and gravel is permitted, to follow the recommendation of our member companies and authorize a uniform increase in flat cents per ton and not to sanction any increase made by the percentage method."



Sand is processed in the two large drag-tanks pictured above.

Derricks Employed to Handle Materials at Southern Gravel Operation

Wet, Sticky Consistency Causes Producer to Adopt Clam-Shells for Plant Service

AS a companion to the new crushed-stone plant of the Watauga Stone Co., Watauga, Tenn., a sand-and-gravel plant was placed in service in the fall of 1930. This extension of the company's activities provides a source of sand as well as gravel and completes its aggregate service to the rapidly-growing eastern Tennessee district. Both plants of the Watauga company are located near Johnson City and Elizabethton, the principal municipalities of this area. The latter city will be remembered as the location of the huge American Bemberg rayon-manufacturing plants—the center for that industry in this country.

The new sand-and-gravel plant is located near Siam, Carter County, Tenn., on the Watauga River and is served by the Southern Railway. Its daily output approximates 15 car-loads.

The plant incorporates several departures from usual materials-handling practice which are worthy of study. Two derricks equipped with clam-shell buckets take the place of inclined conveyors, one unit being installed at a track sump to deliver raw materials to an overhead hopper which sends the materials into the scalping screen, while the other unit is used for stock-pile service and for the reëntry of stock-pile materials to the plant for re-washing and rescreening. Special attention was paid to the design of efficient sand-processing equipment, since sand is the important part of the plant output.

The Watauga River, a common source of sand and gravel for a number of plants in eastern Tennessee, provides the raw material for the Watauga stone plant. Material is excavated by means of a drag-line, not in the river bed but in a deposit adjoining the bank. With 100 acres of deposit available, channel cuts are made for the full length of the property, the first cut having been made within a few feet of the river bank. Through several openings in the bank, the river is allowed to flow into the channel cuts. It is expected that the depleted cuts will eventually be refilled with new material by the natural flow of the river. For excavating the deposit, a Monighan steam-powered drag-line equipped with a 2-cu.yd. bucket is employed. The pit-to-plant transportation system in-

cludes a Vulcan 18-ton locomotive with a train of Western 18-ton cars, the length of haul being approximately a half-mile.

The derrick method of handling raw materials from the transportation system to the plant owes its selection to the wet condition of the material. Because of the immediate entry of river water into the channel cuts, considerable water is taken along with each cut of the drag-line bucket and, consequently, the material arrives in a condition not unlike that of extremely wet concrete. A concrete sump, 18 ft. by 12 ft. by 12 ft. deep and located at a place convenient to the plant, receives the material from side-dump cars. From the sump, a Knoxville Foundry & Machine Co. stiff-leg derrick, equipped with a Blaw-Knox 1½-cu.yd. clam-shell bucket, delivers the wet sand and gravel to an overhead hopper

Clam-shell bucket being manipulated over track sump.

The drag-line in action on a channel cut.

which serves an entry to the scalping screen. The derrick has a 45-ft. mast with a 60-ft. boom and is operated by a Clyde Iron Works 3-drum hoist, the latter being driven by a 100-hp. motor.

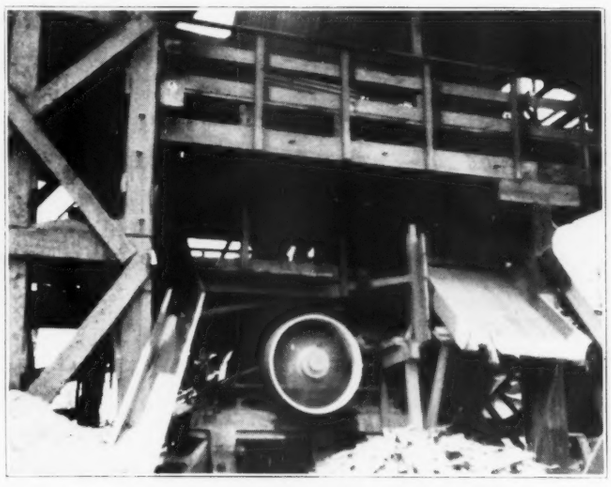
A bird's-eye view of the flow of materials through the plant will reveal a simple and effective processing method. After passing through the usual scalping screen, with a crusher in closed circuit, the sand is separated from the gravel in a conical screen and thereafter both materials are handled separately. The overhead hopper, a timber structure, 18 ft. by 20 ft. by 10 ft. deep, provides a constant supply of material to the scalping screen, the flow being aided by a stream of water from a 6-in. pipe-line. Gravel above 2½ in. in size is rejected by the 48-in. by 12-ft. revolving scalping screen which sends it to a Buchanan 12-in. by 36-in. jaw crusher. The latter is set at 1¾ in. and discharges to two conveyors which return the crushed material to the overhead hopper whence it goes to the scalping screen. Twenty-inch belt-conveyors are used in the closed-circuit system, one 79 ft. long and the other 84 ft. long (between pulley centers), both being driven by 7½-hp. motors. A 35-hp. motor operates the scalping screen and a 40-hp. unit the Buchanan crusher. "Throughs" from the scalper pass directly to a Gilbert 48-in. by 64-in. conical

The sand-and-gravel plant of the Watauga Stone Co.

The scrubber and conical-screen equipment. Car-loading platform on right.

screen which separates the sand from the gravel. A ⅜-in.- or a ¼-in.-mesh screen panel is employed as specifications require.

Following the flow of the sand—the important product of the plant—it will be observed that it is



Jaw crusher with inclosed scalping screen overhead.

sent through two sand-drag tanks in series, thence to a 20-in. belt-conveyor which delivers it to a stock-pile or to a car-loading belt-conveyor. The two sand-tanks have 18-ft. horizontal sections followed by 20-ft. inclines, the latter pitched at an angle of 35 deg. Both tanks are made of reinforced concrete, and are wide enough to accommodate 6-ft. drag-paddles. For the drag, Taylor-Wharton No. 145 chain is used, fitted with 8-in. steel-tipped paddles. A 35-hp. General Electric Motor drives both drag-chains through gear-and-chain reductions. The discharged sand from the first drag-tank is washed into the second tank by a flume; the discharge from the second tank becomes the finished concrete sand. The conveyor which transports it to the stock-pile or to the car-loading conveyor is 84 ft. long between centers and is driven by a 7½-hp. motor. The car-loading conveyor likewise has a 20-in. belt and is 88 ft. long between centers.

Fine grades of sand are reclaimed from the wash-water through a sand-pump and pipe-line. Flumes carry the waste wash-water from both tanks to a concrete sump. The latter supplies a Wilfley 6-in. pipe-line which carries the discharge to a series of small stock-piles, over which the line is supported on bents. At various points the pipe-line is tapped to allow several grades of fine sands to be precipitated to the piles beneath.

Returning to the Gilbert screen to follow the flow of the gravel, it will be observed that, when materials acceptable for Tennessee Class A concrete are required, this gravel is sent through a scrubbing process prior to screening, thence to stock-piles. Otherwise, the gravel is sent direct to stock-piles in a gradation ranging from 2¼ to ¼

This stock-pile derrick returns gravel to the rewashing and rescreening plant.

Drag-scraper at work on stock-piles.

in. Delivery from the Gilbert screen to the scrubber is made by a 28-in. belt-conveyor 87 ft. long between centers. The scrubbing-and-screening equipment consists of a Link-Belt 48-in. by 12-ft. revolving cylinder-type scrubber and a Dull conical screen. The latter is fitted with a ¼-in.-opening perforated plate, or any other size as required by specification, the purpose of the screen being to eliminate enough of the fine gravel to bring the material within the desired specification limits. The fine

Pump and pipe-line for fine sand reclamation.

"throughs" from this unit are returned to the sand-drag and the gravel is sent to a 20-in. belt-conveyor which delivers it to a car-loading platform above a side-track. When no cars are to be loaded, a second 20-in. belt-conveyor transfers the gravel to a large stock-pile, where a Sauerman ¾-cu. yd. power drag-scraper spreads it in fan-shaped piles. Both conveyors are operated by 7½-hp. motors.

The second derrick at the Watauga sand-and-gravel plant is placed where it can be of service in loading stock-piled gravel into cars, or in transferring the material to the Link-Belt scrubber and Dull screen equipment for rewashing and rescreening. Because of the wider area covered, a 70-ft. boom is installed on this derrick, and it is equipped with a 1-cu.yd. Blaw-Knox clam-shell bucket. The entire unit is operated by a 60-hp. motor-driven hoisting engine. An overhead hopper receives the gravel from the clam-shell bucket and feeds it directly to the scrubber. Through this equipment, stocked gravel can be quickly prepared for Tennessee Class A specification concrete. Under normal conditions, the scrubber and screen are not used.

Wash-water is supplied to the plant from the Wautauga River by a Fairbanks-Morse 8-in. centrifugal pump direct-driven by a 35-hp. motor.

H. I. Young is president of the Watauga Stone Co. and R. S. Campbell is vice-president. Ed. Reynolds superintends the operation of the sand-and-gravel plant.

Dimension Stone Sales in Bedford Area Lower Last Year

The sales of stone for construction from the quarries of the Bedford-Bloomington oolitic limestone district, Lawrence and Monroe Counties, Indiana, in 1930, as reported to the United States Bureau of Mines, Department of Commerce, by the producers, amounted to 12,308,340 cu. ft. valued at $15,276,-487. This was a decrease of 12 per cent. in both quantity and value as compared with 1929. These figures include 5,384,090 cu. ft. of rough blocks, valued at $2,629,943; 3,261,000 cu. ft. of sawed stone valued at $2,719,630; 161,890 cu. ft. of semi-finished stone valued at $271,630; and 3,501,360 cu. ft. of cut stone valued at $9,655,284. Compared with 1929 these figures represent a slight increase in the output of rough blocks but a decrease in the output of the other classes of stone. There was a decrease in total value for each class of stone, accompanied by decreases in average unit values for rough, sawed, and semifinished stone, and by an increase in the average unit value of cut stone sold.

Stone sold by quarry operators to the finishing mills of the district and dressed and resold by them in 1930 amounted to 1,991,000 cu. ft. valued at $4,645,824, an increase of 45 per cent. in quantity and 38 per cent. in value over 1929. Some companies having both quarries and mills reported their quarries idle and their mills working on stone obtained from other quarry operators, which is reflected in the increased output of milling companies. The total sales of finishing plants included sawed stone, 197,990 cu. ft. valued at $124,946; and cut stone, 1,793,010 cu. ft. valued at $4,520,878.

ELIMINATION of circulating loads to reduce handling costs at the plant points the way to increased profits. How this was accomplished at the new plant of the East Tennessee Sand & Gravel Co. is interestingly described in an article beginning on page 39.

Utilization of Finer Sizes of Gravel in Concrete-Highway Construction*

By BERT MYERS
Engineer, Materials and Tests, Iowa Highway Commission

SOME of the concrete mixtures that have been used by the Iowa State Highway Commission in the construction of bridges and pavements are unusual in two respects:

(1) The ratio of fine to coarse aggregate is greater than is commonly specified.

(2) The grading of the coarse aggregate sometimes used in these mixtures is different from that which is commonly specified. . . .

One of the principal reasons for the use of such unusual mixtures is economic. In Iowa, deposits of material suitable for use as coarse aggregate in concrete are neither extensive nor well distributed. There are no exposures of igneous rocks and the only exposure of siliceous rock is one of quartzite occupying an area of only a very few acres in the extreme northwest corner of the state. Throughout most of the state the country rock, which is limestone, is buried under many feet of glacial till. Not all the limestone exposed, in places where the glacial drift was originally thin or where it has been removed by erosion, is suitable for use as coarse aggregate in concrete. Much of this limestone is very soft, unsound, or interbedded with frequent seams of shale or clay.

The gravel deposits of Iowa are of glacial origin. These are not extensive or well distributed. While nearly all the state is covered with the drift from one or more of the five glaciers that invaded the state, only two of these drift sheets have contributed important deposits of gravel. These are the Wisconsin, which covers the north central part of the state, and the Iowan, which covers a part of the northeastern part of the state. The Kansan drift, which covers practically the entire southern half of the state, contains no known deposits of sand or gravel of sufficient extent to be of commercial importance.

Sand and gravel derived from the Wisconsin and Iowan drift sheets have been carried beyond the limits of the drift sheets by the action of streams. As may be expected, the particles of small size have been carried farther from their glacial sources than the larger particles. Thus, sand is more widely distributed than gravel. (See Fig. 1.)

The gravel deposits referred to do not contain a high percentage of pebbles, and, of the pebbles present, a high percentage are of small size. It has been estimated that, in the gravel deposits developed commercially in Iowa, the percentage of pebbles is approximately 30, and that, of these pebbles, 40 per cent. are smaller than ⅜ in. in size. In this paper, particles passing a sieve having 0.185-in. square openings are considered sand, and those retained on this sieve are called pebbles.

From this discussion the importance of conserving the coarse aggregate resources of the state is apparent.

Before any extensive program of highway improvement was started in Iowa, the highway officials recognized the fact that, throughout a considerable part of the state, the materials for ordinary concrete mixtures would be very expensive. This high cost would be due to the general scarcity of coarse material and the great distances that such coarse materials would need to be transported. R. W. Crum, now director of the Highway Research Board, was

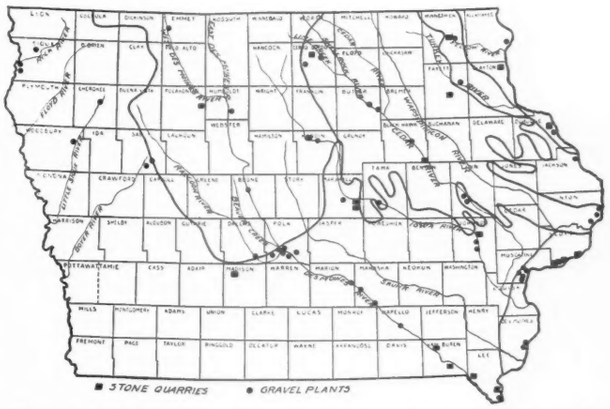


Fig. 1. Distribution of commercial sand, gravel and crushed-stone operations in Iowa.

at that time connected with highway work in Iowa as a member of the staff of the Engineering Experiment Station of Iowa State College. Mr. Crum believed that good engineering did not always consist of using only the materials and designs that had been proved satisfactory by previous use under conditions other than those affecting the work at hand. He believed that good engineering consisted of developing designs for the proper use of the materials available at a reasonable cost.

Therefore he conducted an extensive study to develop a method of designing concrete mixtures to meet the following conditions:

(1) That the concrete produced should have a strength satisfactory for the use for which the concrete is intended.

(2) That the materials required should be the most economical for use under the conditions existing in Iowa.

This work is reported in Bulletin 60 of the Engineering Experiment Station of Iowa State College. It resulted in the development of the theory from which the Standard Proportions for concrete of the

* Paper presented at fifteenth annual convention, National Sand & Gravel Assn.

Iowa Highway Commission are designed. Table I shows this series of proportions. It will be noted that six different proportions are specified and that the percentage of sand in the total aggregate varies from 33 in the first proportion to 60 in the last. The proportions are so designed that the concrete produced from all these mixtures falls in the same class as to strength. The method of arriving at these proportions is stated as follows:

"For determining the amount of cement to make concrete equivalent to any base mixture, when the percentage of sand in the total aggregate varies from the base mixture, decrease or increase the ratio by weight of the total aggregate to cement by 0.05 times the increase, or decrease in the percentage of sand in the total aggregates by weight."

The specifications allow the contractor to use any of the six mixtures that he may select. He ordinarily selects the one that results in the lowest cost of materials for a unit volume of concrete. Which mixture will prove cheapest on a given job will depend upon the relative delivered costs of the various materials.

It will be noted that all except the first proportion listed are over-sanded mixtures. The use of over-sanded mixtures makes it possible to conserve the supply of coarse aggregate in two ways:

(1) Such over-sanded mixtures require less coarse aggregate and more sand and cement per unit volume of concrete than mixtures containing a minimum amount of sand.

(2) By the use of over-sanded mixtures, it is possible to avoid the waste of coarse aggregate that might be necessary to render the grading of the coarse aggregate suitable for use in a mixture containing a minimum amount of sand.

It is generally conceded that in concrete mixtures the volume of mortar present should be slightly in excess of the volume of the void space in the coarse aggregate. Therefore, in mixtures containing a small quantity of mortar, the coarse aggregate must be so graded as to contain a low percentage of voids. Such a grading is ordinarily considered to be one in which there is no excess or deficiency of particles of any particular size. It is quite obvious that as the volume of mortar in a unit volume of concrete is increased, the importance of the grading of the coarse aggregate is decreased. For instance, in a mixture containing equal quantities of sand and coarse aggregate, the all-coarse aggregate might be of a single size and still there would be more mortar in the mixture than would be required to fill the voids in the coarse aggregate.

It was stated previously that the gravel removed from deposits in Iowa contains about 40 per cent. of particles smaller than ⅜ in. and larger than .185 in. This is about twice the percentage of this size of particles considered allowable in coarse aggregate to be used in concrete mixtures where the total aggregate is composed of about 33 per cent. sand and 67 per cent. coarse aggregate. Obviously such a mixture, made from cement and the product of an ordinary Iowa gravel pit, would require a great waste of both sand and small-size pebbles. While it may not be true that all this excess of sand and small-size pebbles would be wasted, there is so little market for such materials that for the purpose of this discussion it will be assumed that these materials would be wasted.

The following computations illustrate the saving in cost that may be made in Iowa by the use of an over-sanded mixture:

Assume that the material in the deposit contains 70 per cent. sand and 30 per cent. pebbles and that 40 per cent. of the pebbles are smaller than ⅜ in. in size.

For the proportion 1:1.718:3.488 specified by the highway commission, the aggregate is one-third sand and two-thirds gravel. The specifications for coarse aggregate for use in this proportion require that the percentage of particles passing the ⅜-in. sieve shall be not more than 30. Assume that, to insure against rejections due to variations in control of grading, the average percentage of particles passing the ⅜-in. sieve must be 20. Then 20 per cent. of the pebbles must be removed, or 1.2 tons of pebbles must be produced for each ton of pebbles used in this mixture. With each ton of pebbles taken from the pit there must be taken out $70 \div 30 = 2\frac{1}{3}$ tons of sand, or a total of $3\frac{1}{3}$ tons of material. Then for each ton of pebbles used in this mixture, $1.2 \times 3\frac{1}{3} = 4.0$ tons of material must be removed from the pit. Of this 4 tons of material produced, only 1 ton of pebbles and ½ ton of sand will be used in this mixture. Assuming that it costs 30 c. to produce a ton of material, the total cost of the 1.5 tons of material used is 4×30 c. = $1.20, which gives the cost per ton of material used: $\$1.20 \div 1.5 = 80$ c. Assuming that cement costs $2.00 per bbl. and that the freight rate from the gravel plant to the contractor's job is 80 c. per ton, the cost of the materials for 1 cu. yd. of this mixture is as follows:

Cement	1.63	bbl. @	$2.00 =	$3.26
Sand	.526	tons @	1.60 =	0.84
Gravel	1.069	tons @	1.60 =	1.71
				$5.81

If this material is used in Mix No. 4, it is necessary to waste none of the pebbles, and sand and gravel are used in equal quantities. In this case, for each ton of gravel used, a total of $3\frac{1}{3}$ tons of material must be produced at a cost of $3\frac{1}{3} \times 30$ c. = $1.00. Of this $3\frac{1}{3}$ tons of material produced, 1 ton of pebbles and 1 ton of sand are used, making the cost of the material used: $\$1.00 \div 2 = 50$ c. Then the cost of the materials required for 1 cu. yd. of concrete of this mixture is as follows:

Cement	1.85	bbl. @	$2.00 =	$3.70
Sand	.75	tons @	1.30 =	0.975
Gravel	.75	tons @	1.30 =	0.975
				$5.650

The difference in the cost of the materials for 1 cu. yd. of concrete is 16 c. in favor of the mixture in which sand and gravel are used in equal quantities.

By similar computations it can be shown that the cost of materials for 1 cu. yd. of concrete of Mix No. 3 is $5.63, which is 18 c. less than the cost computed

for materials for Mix No. 1. The saving accomplished by the use of the over-sanded mixtures increases as the cost of producing the material increases. If the cost of producing materials is 40 c. per ton, the costs of materials for 1 cu. yd. of concrete (all other conditions remaining the same as were assumed before) are as follows:

For Mix No. 1	$6.23
For Mix No. 4	5.79
Difference	$ 0.44

From these computations it seems evident that some economic savings can be made possible by the use of oversanded mixtures under conditions as they exist in Iowa.

Obviously, it would not be wise to use such oversanded mixtures unless the concrete produced is of satisfactory quality. Table II shows the results of strength tests made of concrete used in pavement construction in Iowa in 1930. This table indicates that the strength of the concrete is practically the same for all the three mixtures commonly used in Iowa.

It should be noted that the material producers take advantage of the specifications that allow higher percentages of smaller particles in the coarse aggregate to be used in the Mixes 3 and 4. While some of the smaller-size pebbles are wasted at some plants in Iowa, this material is wasted because it is not economical to remove the sand from all the small-size gravel present in the deposit, or the small-size gravel contains a high percentage of shale particles. Thus the strength tests reported for Mixes 3 and 4 represent concrete, in a considerable part of which the coarse aggregate contains a percentage of small-size particles considerably greater than is ordinarily considered allowable.

Somewhat more definite data as to the effect of small-size pebbles upon the strength of concrete are shown in Fig. 2. The data for this figure were taken from a study of this subject conducted by the Iowa Highway Commission in 1925. In this study, concrete was mixed in three proportions, using a single cement, a single sand, and a single gravel. The gravel used as coarse aggregate was screened and recombined to form four artificial gradings, as shown in the table at the bottom of the figure. The consistency as measured by the slump test was the same for all specimens. This corresponded to a slump of 1½ in. Each point on the diagram represents the average of thirteen tests, except for a few that represent an average of twelve.

The specimens for the transverse tests were beams 8 in. deep and 30 in. long. Of each group of thirteen, ten beams were 4 in. wide, and three were 8 in. wide. The specimens for compressive tests were all cylinders 6 in. in diameter and 12 in. high.

The individual test results show wider variations than would be expected from similar work done today. This may be due to the fact that the laboratory facilities available at the time this work was done were not of the same standard as would be available now.

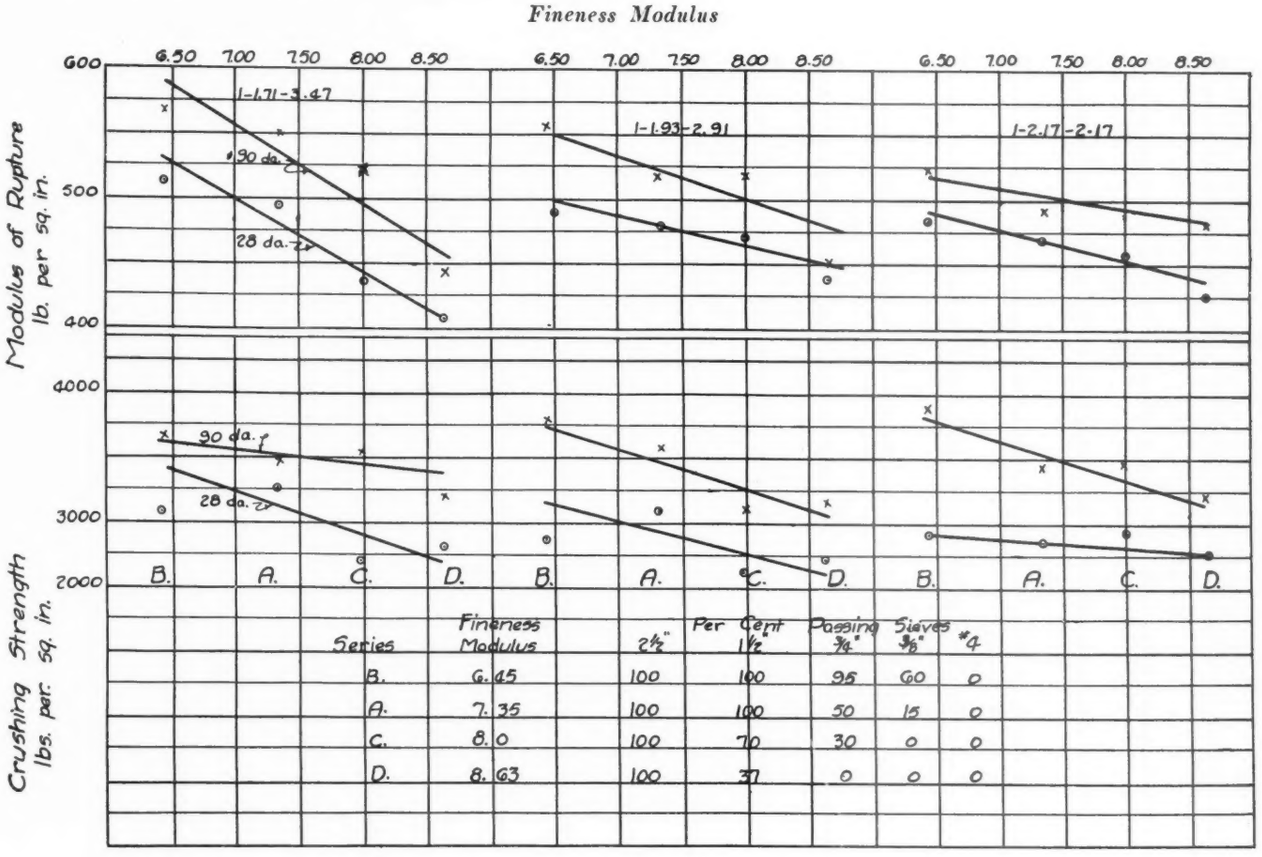


Fig. 2. Variations in strength of concrete with variations in grading of coarse aggregates.

Table I.—IOWA STATE HIGHWAY COMMISSION SPECIFICATIONS FOR CONCRETE MIXTURES FOR CONCRETE PAVING

Mix No.	Proportions by Weight	Aggregate		Cement	Specified Grading of Coarse Aggregate (*per cent. passing square-mesh sieves*)				
		Fine (*per cent.*)	Coarse (*per cent.*)	(*bbl. per cu. yd.*)	2-in.	1½-in.	¾-in.	⅜-in.	0.185-in.
1	1-1.718-3.488	33	67	1.63	100	95–100	40–70	10–30	0–5
2	1-1.946-2.919	40	60	1.71	100	80–100	30–80	10–40	0–5
3	1-2.067-2.526	45	55	1.78	100	70–100	20–90	5–50	0–5
4	1-2.170-2.170	50	50	1.85	100	70–100	20–90	5–50	0–5
5	1-2.258-1.848	55	45	1.92	100	70–100	20–90	5–50	0–5
6	1-2.315-1.543	60	40	2.00	100	70–100	20–90	5–50	0–5

The averages shown in the diagram seem to be sufficiently consistent to justify the conclusion that when concrete is proportioned by weight no loss of strength may be expected from the use of coarse aggregate containing a high percentage of particles of small size.

Unfortunately, there is no satisfactory laboratory method for measuring the property of concrete known as workability. Consequently, the results of this study do not furnish a basis for a conclusion as to whether coarse aggregate of a given grading when mixed in concrete of a given proportion will produce a mixture with a degree of workability satisfactory for field use. Probably the gravel used in Series B, mixed in the proportion 1:1.71:3.47, would produce a mixture too harsh for use in the construction of pavements, bridges, and buildings. However, this harshness could be overcome by the use of a proportion containing a higher ratio of

Table II.—STRENGTH TESTS OF CONCRETE 1930 PAVING CONSTRUCTION—GRAVEL AGGREGATE

Mix No.	Modulus of Rupture at 7 Days			Modulus of Rupture at 28 Days			Crushing Strength at 28 Days		
	No. of Tests	Modulus, (*lb. per sq. in.*)	Per Cent. of Avg.	No. of Tests	Modulus, (*lb. per sq. in.*)	Per Cent. of Avg.	No. of Tests	Strength (*lb. per sq. in.*)	Per Cent. of Avg.
2	263	623	101.8	264	695	101.6	247	4511	100.6
3	519	589	96.2	509	663	96.9	511	4318	96.2
4	92	623	101.8	108	695	101.6	104	4629	103.2
Avg.		612			684			4486	

mortar to coarse aggregate. The data shown in the diagram would indicate that this would result in no loss of strength.

Strength and workability are not the only important properties of concrete. Volume changes, or the effects of volume changes, are also important. The formation of the ordinary transverse cracks in concrete pavements is evidence of the effects of these volume changes. Table III shows the spacing of transverse cracks in Iowa pavements as determined by a crack survey made in November and December, 1929. These data indicate that, while there is no considerable difference in the spacing of cracks built of concrete mixed in the proportion 1:1.718:3.488 and those built of concrete with the proportion 1:1.946:2.919, the use of the proportion 1:2.067:2.526 has caused a considerable decrease in the distance between cracks. But since these are data taken from the field, it can not be assumed that the difference in the proportions or the grading of the coarse aggregate is entirely responsible for the difference in the spacing of the cracks. Other differences in the coarse aggregate and variations in other conditions affecting the pavements studied may have influenced this spacing of cracks. This is suggested by the data shown in Table IV. These are the same kinds of data as those shown in Table III, except that the data for the pavements studied are separated according to the source of the coarse aggregate used. These data would seem to indicate that the spacing of the cracks is influenced more by some characteristic of the aggregate from a given source than by the proportion in which it is used. The data from Table IV would seem to indicate that if the effects of volume changes in concrete are to be accurately controlled, a study

Table III.—CRACK SPACING IN CONCRETE PAVEMENTS BUILT WITHOUT JOINTS—GRAVEL AGGREGATE FROM ALL SOURCES

Year Built	Mix No.	Miles Surveyed	Avg. Distance Between Cracks (*ft.*)
1927	1	17.56	62.29
	2	11.61	70.53
	3	1.10	37.90
1928	1	36.31	61.56
	2	135.94	64.91
	3	58.06	44.28

must be made of the aggregate from each source. The author does not wish to imply that more transverse cracks do not develop in pavements built of very rich, highly over-sanded mixtures than in those

Table IV.—CRACK SPACING IN CONCRETE PAVEMENTS BUILT IN 1928 WITHOUT JOINTS—GRAVEL AGGREGATE FROM SPECIFIC SOURCES

Source of Coarse Aggregate	Mix No.	Miles Surveyed	Avg. Distance Between Cracks (*ft.*)
B.	1	9.56	34.83
	2	.....	.....
	3	0.7	34.8
M.	1	8.15	69.18
	2	27.11	66.73
	3	0.28	43.48
	4	0.62	56.02
I.	1	8.46	72.02
	2	32.28	68.00
	3	10.53	55.01

built from mixtures containing less cement and sand. The few miles of pavement in Iowa built from concrete, in which the percentage of pebbles in the aggregate was only 30, have developed transverse cracks at intervals of about 15 ft. Pavements built from the Platte River material, that contain only 10 or 12 per cent. of pebbles, have developed cracks at average intervals of about 23 ft.

The author believes that the results obtained have justified the policy followed by the Iowa Highway Commission in the economical use of the materials available. We believe that the designs and methods used are worthy of study.

DREDGING operators faced with the problem of how to utilize their equipment to the fullest extent in actual production will be interested in the combined dredge and barge recently put into service by the Home Sand & Gravel Co. of Fremont, O. Story begins on page 49.

Richmond Dale plant as seen from U. S. highway.

Three Trains Operate Efficiently Over One Track from Pit to Plant

Systematic Routing of Traffic Enables Gravel Cars to Function with Dispatch

THE employment of a unique pit-to-plant transportation system of relatively high capacity over a single track distinguishes the Richmond Dale plant of the Miami Gravel Co. near Chillicothe, O., as one of more than ordinary interest. With an unusually fortunate location which offers a pit deposit as well as a river deposit of raw material—both located adjacent to the main lines of the Baltimore & Ohio and Chesapeake & Ohio Railroads—this plant is ideally situated for both commercial and ballast business.

The plant facilities were originally designed by the Webster Mfg. Co. (now Webster & Weller Mfg. Companies) and much of the equipment, such as conveyors, elevators, screens and the like, was furnished by that company. Present production facilities provide an output of 200 tons per hr. The design of the pit-to-plant transportation system and many other improvements are credited to W. L. Talbot, superintendent of the Richmond Dale plant and also secretary of the company.

When operations began in 1928, raw material was obtained from the Scioto River, the plant having been built on a location most convenient to both the deposit and the railroad. Material was won from the river bed by means of a Sauerman slack-line cableway equipped with a 1½-cu. yd. bucket. Depletion of the river-bed deposits occurred at a more rapid rate than the natural flow of the river could replace; this, with a continued large demand for materials, forced the company to open an adjoining 60-acre pit deposit. The cableway equipment has not been dismantled but will remain in place for possible future use.

Supt. W. L. Talbot

Passing track and service station, pit-to-plant transportation system.

Drag-line in action on 24-ft. cut.

Wash water pumps. Note inclined tracks.

The pit deposit averages 24 ft. in depth with a 4½-ft. layer of overburden which consists of a sandy loam easily stripped. This source of raw material is unusually good in that the percentage of "oversize" to be crushed is small and is free from objectionable clay or other foreign matter. A method of recovery not unlike that used in the pebble-phosphate mining district of Florida is employed. Cuts 1,600 ft. in length and 45 ft. in width are made, the operation being headed by a drag-line which strips them of overburden and overcasts the 4½-ft. layer of soil into the depleted cut alongside. Another drag-line follows the first to excavate and load the gravel into pit cars waiting on a track adjacent to the cut. (Hydraulicking is usually used for excavating the pebble-phosphate bed after stripping.) When the stripping machine completes its cut, it is returned to the far end of the pit site to begin another. As it proceeds, the pit-car track is relocated, section after section, by means of the long boom. Little or no interference is made with the movement of the pit cars and the track is already in place for the new cut when the excavating-and-loading machine completes its work in the old one.

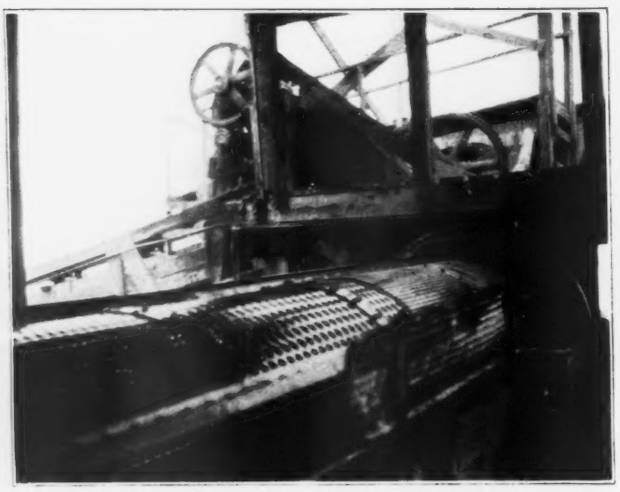
Pit operations are carried on by two Thew-Lorain "75" drag-lines. One unit, equipped with a 60-ft. boom and operated with a ¾-cu. yd. bucket, is employed on the stripping and track-shifting operation, while a similar size machine with a 1¼-cu. yd. bucket is assigned to the excavating and loading job.

Of more than ordinary interest in this gravel-pit operation is the system of transporting the pit-run material to the plant. Despite the need for three trains to keep the plant and loading machine operating efficiently, but a single track is in use. In the ¾-mi. length of track between the plant receiving-hopper and the pit there are two passing tracks, each of a length sufficient to accommodate

Stripping 4½-ft. overburden with second drag-line.

an 8-car train. Traffic is routed so that the loaded train on its way to the plant has a clear track ahead.

A typical situation will find one train being loaded at the drag-line, another train at the plant receiving-hopper with most of its cars unloaded, and the third train temporarily waiting on a passing track near the pit. Immediately after its cars are unloaded, the train at the plant returns to the first passing track to clear the way for a train bearing loaded cars on its way to the plant. The train of empty cars at the passing track near the drag-line then proceeds without delay to the drag-line and the second train of empty cars takes its place. The system has worked to a high degree of satisfaction. Delays at the drag-line are but momentary and, with the stripping machine serving also as a track shifter, productive time losses few.



Scalping screen, scrubber section on far end.

The New AMSCO Type "C" Pump

AMSCO again meets current demand with a low cost, long lasting, high capacity pump. This latest addition to the AMSCO Line of materials handling pumps is the new Type "C" which because of its many features promises to be widely used by sand and gravel producers for both primary and secondary pumping.

The new Type "C" Pump is strictly AMSCO in design, yet extremely low in cost. Made to the same high standards and of the same superior AMSCO Manganese Steel (for water end parts), "the toughest steel known," as are all other AMSCO Pumps.

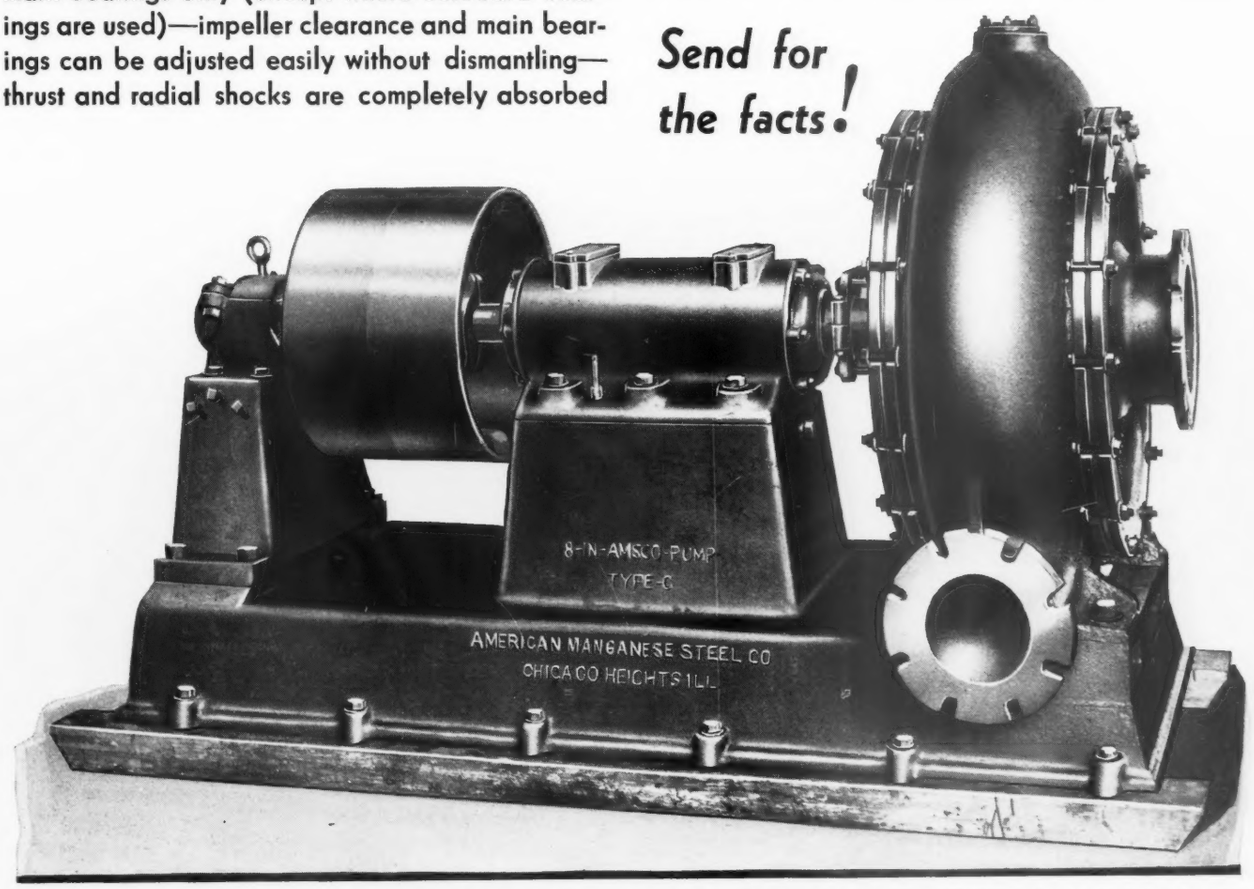
Long life and freedom from breakage and wear are designed into every part. Bearings are interchangeable in the field, either sleeve or anti-friction types being available—lubrication is required on main bearings only (except where outboard bearings are used)—impeller clearance and main bearings can be adjusted easily without dismantling—thrust and radial shocks are completely absorbed by new bearing arrangement. In short, the new AMSCO Type "C" Pump is just what many operators have been waiting for.

Read These Advantages:

Rugged, oversized construction at low cost.
Main bearing is interchangeable with sleeve or anti-friction bearings.
Main bearings can be adjusted without dismantling.
All wearing parts are made of AMSCO Manganese Steel.
Two bearings absorb radial and thrust loads.
Impeller clearance is easily adjusted.
Lubrication is simplified.
Proper alignment is assured.

Use the AMSCO Type "C" Pump on your next job —write now for complete details and specifications so that you will have the facts when you need them.

Send for the facts!



AMERICAN MANGANESE STEEL COMPANY, 377 EAST 14th STREET, CHICAGO HEIGHTS, ILLINOIS

Foundries at Chicago Heights, Illinois—Burnside, Chicago, Illinois—New Castle, Delaware—Oakland, California—Los Angeles, California—Denver, Colorado—St. Louis, Missouri.

AMSCO

Sales Offices at New York—Cambridge, Mass.—Easton, Pa.—Lakeland, Fla.—Pittsburgh—Cleveland—St. Paul—Portland, Ore.—Seattle—Vancouver—Winnipeg—Tulsa—Houghton, Mich.—New Orleans—Pittsburg, Kans.—Salt Lake City—Chicago—Chicago Heights, Ill.—New Castle, Del.—St. Louis—Denver—Oakland—Los Angeles

At the plant a 24-cu. yd. receiving hopper provides adequate surge capacity to insure a constant supply of material during the time between the departure of the empty-car train and the arrival of the train of loaded cars.

This transportation system employs three Plymouth 8-ton locomotives and 24 Western 4-cu. yd. side-dump pit cars which are operated in 3 trains of 8 cars each. Two additional cars are held on a side-track for emergency replacement. This side-track, incidentally, leads to an A-frame boom which is fitted with a winch. Car bodies are manipulated off and on the chassis with this equipment.

Not far away on a passing track an automobile-service-station type of gasoline pump is located to

Loading facilities with locomotive shown in foreground.

Loaded train on way to plant; passing track for returning empties on left.

dispense gasoline to the locomotives. An attendant, who also acts as switch man, is required to fill out a printed ticket for every 10-gal. filling of gasoline. On this ticket the attendant records the number of the locomotives served, the quantity of gasoline received, the date, and so on. These tickets are signed and sent to the office, where accurate cost records are kept. Through the ticket system gasoline shortages are eliminated, as the attendant is entirely responsible for the service.

The flow of materials through the plant is not unlike that of many others designed within the past three years. Its flow-sheet reveals the use of a rotary combination scrubber and scalping screen for the first processing operation, a vibrating screen for sizing the gravel, and a settling tank for the preparation of the sand. The efficiency of the system, as well as of the individual units comprising it, is attested by the fact that no material has ever been rejected in the plant's history.

From the track hopper, two conveyors transport the material to the plant. The first unit, a Telsmith 180-ft. field conveyor, extends from the hopper, where a Telsmith feeder supplies it with a uniform load of material, to a second hopper, which originally received material from the slack-line cableway.

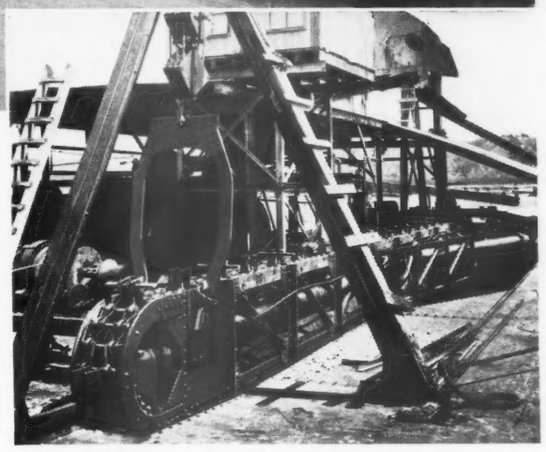
This hopper is equipped with a Webster rotary feeder supplying the plant inclined conveyor. A 40-hp. motor powers the inclined conveyor, which has a center-to-center length of 310 ft., and a 5-hp. motor serves the Telsmith field conveyor. Both conveyors are equipped with U. S. Rubber Co. 24-in. belting.

The discharge from the inclined conveyor is made into a perpendicular chute which feeds the combination scrubber and scalping screen. A jet of water from a 4-in. pipe-line is introduced in the chute to supply sufficient water for the scrubbing process as

Track hopper in distance with conveyor system leading to plant.

Double-deck classifying screen. Note heavy wash-water spray.

FIRST EAGLE "SWINTEK" LADDER



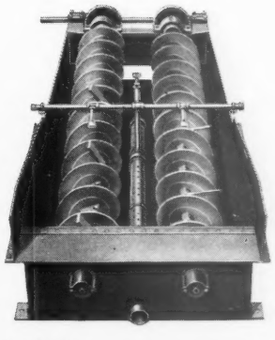
Installed For Digging Fine Sand » Makes Good » 45% Production Increase!

The Pioneer Sand Company, St. Joseph, Missouri, operating a 50' EAGLE Ladder with 10" suction pipe, are pumping 45 per cent more sand than with the old suction method. Here is definite evidence to disprove the claims of many operators that an agitator is not suitable for pumping sand only—and the facts were given us by the users.

They say, "The addition of the EAGLE 'Swintek' Ladder to our equipment is the best step forward we have ever made." Production has been increased and the product improved and made coarser by agitating the deposit so that the river current carries away the very fine, silty sand.

The EAGLE "Swintek" Ladder is the only method available by which production may be materially increased, the product improved and dredge operating costs lowered—ample reason why you should write us at once for complete information as to possible savings on your work.

The Pioneer Sand Company, St. Joseph, Missouri are enthusiastic boosters of the EAGLE "Swintek" Ladder. This company has produced sand from the bed of the Missouri River since 1900, but never as fast as with their recently installed EAGLE "Swintek" Screen Nozzle.



EAGLE Sand and Gravel Washers are ruggedly built to give years of trouble-free service. Prepare your sand for market the EAGLE way.

EAGLE Products Include:

EAGLE Double Roll Crusher · Olson Self-dumping Cages · EAGLE Dry and Wet Pans
EAGLE Shale Planer · Specialized Mining Equipment · EAGLE Grinder

EAGLE IRON WORKS
DES MOINES - IOWA

well as to assist the flow of material into the scrubber. By means of the 8-ft. 6-in. scrubber section—an inclosed drum fitted with agitator blades—the material is given a thorough scrubbing which results in the dissolution of the clay and silt found in the deposit. The scrubber section discharges to the 10-ft. 6-in. scalping-screen section, which contains three panels of Morrow 1½-in.-opening perforated plate. Rejected gravel is chuted to a Telsmith crusher set at 1¼-in. breakage and the crushed gravel is returned to the scalping screen by a 14-in. chain bucket-elevator. Material passing the scalping unit is sent to a Plat-O 4-ft. by 8-ft. double-deck vibrating screen, which classifies it into sizes suitable for ballast or concrete aggregate. Five pipe jets send water under 40 lb. pressure through the gravel as it passes over the vibrating-screen panels. Sand from the lower deck is chuted to a Webster & Weller 16-ft. sand-settling tank. Either masons' or concrete sand is produced by this equipment. Motors used to drive the plant equipment include a 30-hp. unit operating the combination scalping screen and scrubber, and a 40-hp. unit driving the Telsmith crusher.

Three McGowan centrifugal pumps furnish the wash-water. One 6-in. unit, driven by a 30-hp. Westinghouse motor, and a 5-in. unit, driven by a 25-hp. General Electric motor, are mounted on trucks at the bank of the Scioto River. As the river level changes, the position of the pumps can be adjusted by small wire-rope winches located on the top of the bank. Flexible-hose suction and discharge connections to the pumps make this movement possible. A 6-in. pump in the main wash-water line acts as a booster. It is powered by a 30-hp. motor.

A timber car-loading bin offers a storage capacity for 200 tons of materials in its 4 compartments. The structure is 20 ft. in width and 45 ft. in length. One car-loading track has access to bin-gates under the compartments, and another alongside the structure has access to gates mounted on the west side. An innovation at this loading bin is found in the means used to prevent dripping water from the bin gates from falling into the loaded cars standing on the track beneath. A telescoping chute, extending from a near column, is quickly pulled out, after a car is loaded, to a position where the dripping water is intercepted. This objectionable, slightly muddy water is then allowed to drain to the ground. A Plymouth 12-ton locomotive is used for car spotting and for general yard service.

Exterior stock-piles of sand to the amount of 25,000 tons allow sufficient storage capacity for this class of material.

Eighteen men are normally employed when the plant is operating on a 200-ton-per-hr. production schedule.

PIT AND QUARRY

Research Department

538 South Clark St., Chicago, Ill.

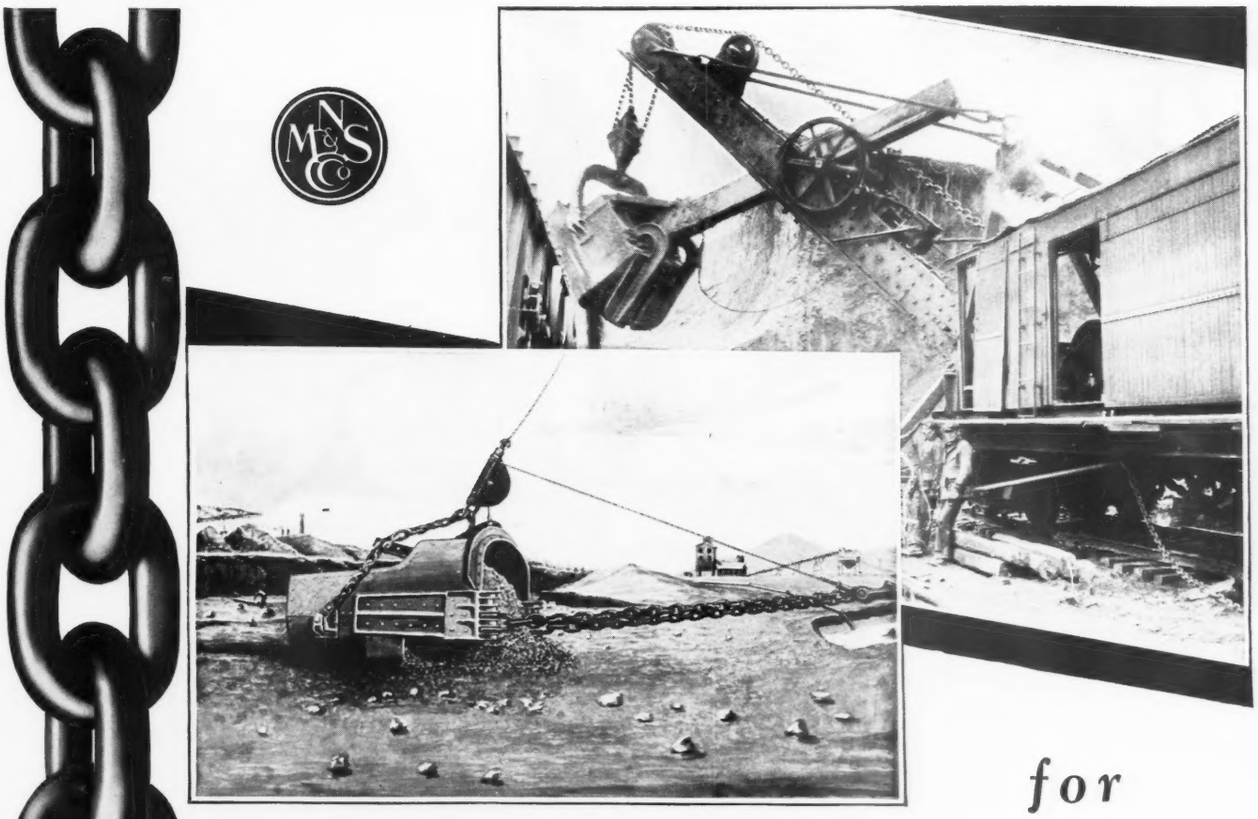
Please send me catalogs and prices concerning the following items checked below:

☐Agitators, sand and Gravel
☐Agitators, Slurry
☐Air cleaners
☐Air compressors
☐Bag filling and weighing machinery
☐Bags, cloth
☐Bags, paper
☐Balls, steel
☐Barges, steel
☐Belt dressing
☐Belt fasteners
☐Belting, conveyor and elevator
☐Belting, transmission
☐Belt lacing
☐Belt plates
☐Belt rivets
☐Belt tighteners
☐Bin gates
☐Bins, concrete
☐Bins, steel
☐Blasting supplies
☐Blasting powder
☐Blocks, friction
☐Boats, self-unloading
☐Bodies, Motor Trucks
☐Brake Linings
☐Buckets, Clamshell
☐Buckets, Conveyor and Elevator
☐Buckets, Dragline
☐Buckets, Orange Peel
☐Cableways, Slackline
☐Calcining Machinery
☐Car Dumpers
☐Car Pullers and Movers
☐Carriers, Belt
☐Cars, Dump
☐Cars, Kiln
☐Castings, Manganese Steel
☐Castings, Steel
☐Chains, Conveyor and Elevator
☐Chains, Power Shovel, Crane and Dredge
☐Chains, Transmission
☐Chutes
☐Classifiers
☐Clips, Wire Rope
☐Clutches
☐Clutches, Magnetic
☐Concrete Plants, Ready Mixed
☐Cones, Washing
☐Conveyors, Apron
☐Conveyors, Belt
☐Conveyors, Pneumatic
☐Conveyors, Screw
☐Conveyors, Skip
☐Coolers
☐Couplings, Flexible
☐Couplings, Hose
☐Cranes, Locomotive
☐Cranes, Overhead Traveling
☐Cranes, Truck
☐Crushers, Cone
☐Crushers, Disc
☐Crushers, Gyratory
☐Crushers, Hammer
☐Crushers, Jaw
☐Crushers, Ring
☐Crushers, Roll
☐Crushers, Rotary
☐Cutter Heads, Dredging
☐Derricks
☐Draglines, Cableway
☐Draglines, Revolving Boom
☐Dredges, Dipper
☐Dredges, Hydraulic
☐Dredges, Ladder
☐Drill Sharpening Machinery
☐Drills, blast hole
☐Drills, Diamond Core
☐Drills, Hand Hammer
☐Dryers, Rotary
☐Dryers, Sand and Gravel
☐Dust Collecting Systems
☐Dynamite
☐Elevators, Bucket
☐Engines, Diesel
☐Engines, Gas
☐Engines, Gasoline
☐Engines, Hoisting
☐Engines, Oil
☐Feeders
☐Filters, Air
☐Filters, Oil
☐Fire Brick
☐Flanges, Pipe
☐Frogs and Switches
☐Fuses, Blasting
☐Gears
☐Goggles
☐Governors
☐Grinding Balls
☐Grizzlies
☐Guns, Hydraulic
☐Hoists, Air
☐Hoists, Derrick
☐Hoists, Drum
☐Hoists, Motor Truck Body
☐Hoists, Skip
☐Hose, Air Steam, Water
☐Hose, Sand Suction
☐Hydrators
☐Kettles, Calcining
☐Kilns, Rotary
☐Kilns, Vertical
☐Linings, Kiln
☐Loaders, Portable
☐Loaders and Unloaders, Box Car
☐Locomotives, Diesel
☐Locomotives, Gasoline
☐Locomotives, Steam
☐Log Washers
☐Measuring Devices
☐Mills, Compartment
☐Mills, Tube
☐Mixers, Plaster
☐Motors, Electric
☐Motors, Gasoline
☐Motor Trucks, Ready Mixed Concrete
☐Nozzles, Hydraulic Mining
☐Nozzles, Gravel Washing
☐Nozzles, Spray
☐Nozzles, Dust Settling
☐Nozzles, Suction Hose
☐Nuggets, Grinding Perforated Metal
☐Poidometers
☐Pulleys, Clutch
☐Pulleys, Magnetic
☐Pulverized Fuel Systems
☐Pulverizers, Ball, Conical, Pebble
☐Pulverizers, Disc
☐Pulverizers, Hammer
☐Pulverizers, Ring
☐Pulverizers, Rod
☐Pulverizers, Roll
☐Pumps, Centrifugal
☐Pumps, Deep Well
☐Pumps, Sand and Gravel
☐Pumps, Slurry
☐Pumps, Steam
☐Radiators, Engine Cooling
☐Rails
☐Refractories
☐Respirators
☐Rollers, Conveyor
☐Rolls, Crushing
☐Rope, Wire
☐Safety Appliances
☐Sand-Lime-Brick Machinery
☐Scales, Track
☐Scales, Truck
☐Scrapers, Dragline
☐Screens, Revolving
☐Screens, Shaking
☐Screens, Vibrating
☐Separators, Air
☐Separators, Dry Centrifugal
☐Separators, Magnetic
☐Shovels, Gasoline
☐Shovels, Steam
☐Skips
☐Sleeves, Dredge
☐Slugs and Nuggets, Grinding
☐Speed Reducers and Gears
☐Spray Nozzles
☐Sprays, Paint
☐Sprockets
☐Steel, Tool
☐Stokers
☐Switches, Track
☐Tanks, Concrete and Steel
☐Tanks, Sand Settling
☐Tanks, Wood
☐Thickeners, Slurry
☐Track, Portable
☐Track Shifters
☐Tractors, Crawler
☐Tramways, Aerial
☐Trippers, Belt
☐Trippers, Tramway
☐Unloaders
☐Valves, Pump
☐Washers and Scrubbers, Sand, Gravel, Stone
☐Weighters, Automatic
☐Welding Supplies
☐Wheels, Car
☐Winches
☐Wire Cloth
☐Wire Cloth, Manganese Steel

Firm Name.....

Individual.....

Address.....*City*.....*State*.....



for

NACO Power Shovels And Draglines

A modern chain, made to withstand extreme shocks and rough usage. A chain with greater strength, more resistant to wear and distortion, less affected by weather conditions, free from welds, and practically stretchless.

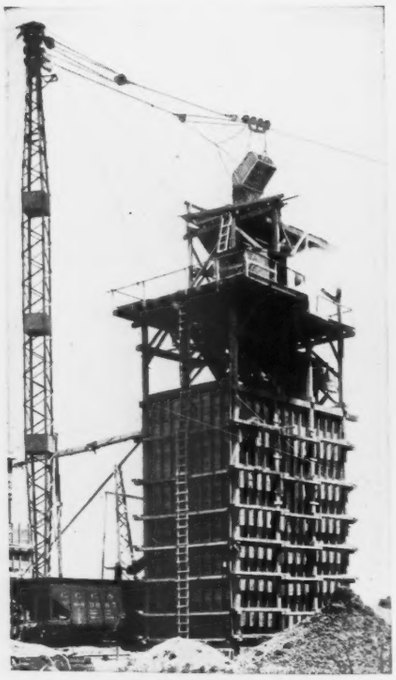
Naco chain is made of "Naco" steel, a heat treated product of the electric furnace, having a yield point approximately three times as great as ordinary steel.

Naco links are absolutely uniform in size and shape, and will therefore operate more smoothly and evenly over the sheaves, and with less wear, thus prolonging the life of both sheaves and chain.

For maximum economy of operation, equip your power shovels with "Naco."

NATIONAL MALLEABLE AND STEEL CASTINGS CO.
General Office — Cleveland, O.

NACO TRADE MARK **CAST STEEL CHAIN**
The Strongest Chain Made



2 cubic yard Slackline Discharging into Hopper over Washing Plant.

150 ton Triple Compartment Bin and three beam Weigh Batcher

A complete line of circular and square Bins, Gates, Volume and Weigh Batchers for Storage, Aggregate Batching. Central and Transit Mixing Plants.

Catalog 100 fully describes various sizes and styles of Beaumont Coppersteel Bins. Send for a copy.

View of F. A. Rider, Inc., Endicott, New York, Sand and Gravel Plant.

Slackline Cableway Excavators
Cable Drag Scrapers
Coppersteel Bins and Batchers

THE Beaumont Slackline Cableway is particularly suited for excavating material from deep pits, under water deposits, working long-span operations, and to convey material to a high discharge point.

The Beaumont Cable Drag Scraper System is used for storing and reclaiming of materials, excavating in pits and high banks. Whatever your problem—there is a proper size and style Beaumont machine to do the job economically and efficiently.

You will be interested to know more about the Beaumont Electro-Auto Hoist, designed especially for Drag Scraper Service. Its exclusive features include automatic operation, remote control, automatic band clutches and brakes. Also *two speeds on Inhaul Cable* giving higher capacities and lower operating costs.

Write today for your copy of Supplement Catalog 95 in which the details are fully explained.

BEAUMONT

320 ARCH ST. PHILA., PA.

20 N. Wacker Drive, Chicago
50 Church Street, New York
Kresge Building, Detroit
Keith Building, Cleveland
Union Trust Building, Pittsburgh
12 Pearl Street, Boston

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

Photo by Strauss

E. J. KRAUSE
President
Columbia Quarry Co.
St. Louis, Mo.

Coming Events

Aug. 30-Sept. 4, 1931. Buffalo N. Y. Eighty-second meeting, American Chemical Society, Hotel Statler.

Sept. 4, 5, 1931. Fresno, Cal. Regular meeting, California Associated Concrete Pipe Manufacturers, Hotel Fresno. A. A. Clark, secretary, Box 368, Visalia, Cal.

Sept. 6-12, 1931. Zurich, Switzerland. First International Congress, International Assn. for the Testing of Materials, Swiss Federal Polytechnicum. American representative, American Society for Testing Materials, C. L. Warwick, Sec., Philadelphia, Pa.

Sept. 10, 1931. St. Louis, Mo. Monthly meeting, St. Louis Quarrymen's Assn., Forest Park Hotel. E. J. McMahon, exec. sec., 4063 Forest Park Blvd., St. Louis, Mo.

Sept. 28-Oct. 1, 1931. Salt Lake City, Utah. Annual meeting, American Assn. of State Highway Officials.

October 12-16, 1931. Chicago, Ill. National Safety Congress. W. H. Cameron, secretary, National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

Jan. 9-15, 1932. Detroit, Mich. Annual Convention and show, American Road Builders Assn. Chas. M. Upham, engineer-director, National Press Bldg., Washington, D. C.

Jan. 19-22, 1931. Pittsburgh, Pa. Annual Convention, National Crushed Stone Assn., Wm. Penn Hotel. J. R. Boyd, secretary, Merchandise Bldg., Washington, D. C.

Jan. 25-26, 1932. Pittsburgh, Pa. Annual convention, National Ready-Mixed Concrete Assn., Wm. Penn Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Jan. 27-29, 1932. Pittsburgh, Pa. Annual convention, National Sand & Gravel Assn., Wm. Penn Hotel. V. P. Ahearn, secretary, Munsey Bldg., Washington, D. C.

Feb. 3-4, 1932. Washington, D. C. Annual meeting, Sand-Lime Brick Assn. Ellen Knight, sec., 321 N. Hamilton St., Saginaw, Mich.

Feb. 23-26, 1932. Washington, D. C. Annual convention, American Concrete Institute, Wardman Park Hotel. Harvey Whipple, sec., 2970 West Grand Blvd., Detroit, Mich.

Pumpings from the Old Pit

Excerpts from the old files of PIT AND QUARRY *reveal many interesting sidelights on the activities of the pits, quarries and plants of former days. These are printed in this column each issue.*

Fourteen Years Ago

THE Ohio Macadam Assn. sent a delegation to Washington, D. C., to see what could be done about the shortage of railway cars in that state. Cars were at a premium due to the emergencies of war and producers everywhere were being urged to see that all cars were unloaded promptly and filled to capacity when loaded.

* * *

The Wilcox Co., producers of sand and gravel at Fontana, Wis., was preparing to fulfill a contract for 75,000 cu. yd. of aggregates to be used in the erection of the Pennsylvania Railroad freight terminal building at Chicago.

* * *

Ten Years Ago

AN editorial paragraph from the August, 1926, issue bears repeating because of its timeliness now as well as then. It stated: "This is a good time to remember that it is not price reduction but price stability which tends to inspire confidence."

* * *

The Greenville Gravel Co. of Greenville, O., announced plans for the erection of a $250,000 sand-and-gravel plant at Massillon, O. Deposits aggregating 100 acres had been acquired in that vicinity.

* * *

Dr. G. J. Fink, a graduate of Cornell University and an experienced research worker, was added to the technical staff in the chemical department of the National Lime Assn.

* * *

New corporations included the following: Stowe Trap Rock Co., Philadelphia—J. P. Murray, Frank S. Murray, and F. Stanley Sauerman; Wm. Wolf Sand & Gravel Co., Inc., West Allis, Wis.—William Wolf, Hugo Schultz, John H. Schmidt; Horicon Sand & Gravel Co., Horicon, Wis.—E. C. Able, Jennie Beichl, W. W. Koch; Decorah Stone Products Co., Decorah, Ia.—S. F. Sellman, W. B. Reed, Richard Bucknell, Sr.

* * *

Five Years Ago

THE Universal Gypsum Co. of Chicago and the Palmer Lime & Cement Co. of New York consolidated, the new company assuming the name of the Universal Gypsum & Lime Co.

The U. S. Bureau of Mines was making experiments with a sintering machine for speeding up the time of burning lime and improving its quality.

* * *

The Evansville, Pa., plant of the Allentown Portland Cement Co. added improvements, among them a Fuller-Kenyon pumping system for handling cement and raw materials.

Selects Five Key Cities for New Branch Offices

The increased volume of business arising from different sections of the country made necessary the recent opening of branch offices of Stedman's Foundry & Machine Works, of Aurora, Ind., in these additional cities: Pittsburgh, Charleston, W. Va., Kansas City, Mo., Chicago and Vancouver, B. C. Goggin & Mills are the Stedman representatives in Chicago. They are located at 407 S. Dearborn St. In Pittsburgh, the representative is Louis Mardaga. His office is at 710 Park Bldg. J. Y. Riffe, 811 Peoples Bank Bldg., will represent the firm in Charleston, W. Va. S. D. Calloway, 3029 Roanoke Road, will represent Stedman in Kansas City, Mo. In Vancouver the Stedman representative is Brown, Fraser & Company, Ltd., 1150 Homer St.

To Develop Rock-Asphalt Deposits in New Mexico

The New Mexico Construction Co., Santa Rosa, N. M., under the presidency of A. B. Hebenstreit, will spend about $100,000 in the development of asphalt-rock deposits, located about five miles from that city. The rock is to be removed by steam shovels, and crushed and processed for use as road material. A branch railroad is to connect it with the Southern Pacific System at Santa Rosa.

New Corporations

CHIEFTAIN MARBLE & LIME CO., Enterprise, Ore. $10,000. F. G. Henning, L. E. Jordan and George P. Cheney.

ARIZONA GYPSUM PLASTER CO., an operating company of Douglas, Ariz., has been incorporated with a capital stock of $100,000. H. W. Williams, S. G. Dowell and Carolina M. Adamson.

WESTERN STUCCO CO., LTD., Vancouver, B. C., Can. $75,000.

UNITED STATES FLUORSPAR CORP. Delaware. $5,000,000. 100,000 sh. n.p.v.

POLGRIM SAND & GRAVEL CORP., Farmingdale, N. Y., increased its capital stock from $20,000 to $60,000.

MATGO GRAVEL CO., Brentwood, N. Y. 200 sh. common.

Personal Mention

S. V. Onderdonk, chemist at the Stroh, Ind., plant of the Wabash Portland Cement Co., has been transferred to the company's plant at Osborne, O.

Elmer E. Meleen and **Maurice E. Kirby,** graduates of the University of South Dakota, have been making a survey of Clay County, S. D., for gravel deposits, and have found supplies ample for the paving of highways in the county. **Dr. E. P. Rothrock,** state geologist, says this is the first county to have a survey made for this purpose.

H. K. Stewart has purchased the plant and equipment of the Meriwether Sand & Gravel Co. at Texarkana, Ark.

F. E. McCaslin, of the Oregon Portland Cement Co., Portland, Ore., was elected president of the Building Material Dealers' Credit Assn. of Portland, at the annual meeting of that organization held recently.

William R. Daley of the firm of Otis & Co. has been elected a director of the Bessemer Limestone & Cement Co., succeeding **Richard Inglis,** who recently resigned.

Ralph P. White, superintendent of the Blubber Bay, B. C., plant of the Petrie Lime Co. was married last month to Katherine Florey Napton of Philipsburg, Mont. The ceremony took place at Helena, Mont. Mr. and Mrs. White will reside in Seattle.

Hugh M. Wolflin of Los Angeles, Cal., has been appointed Supervising Engineer of the Intermountain Experiment Station of the United States Bureau of Mines, Department of Commerce, Salt Lake City, Utah, as announced by Scott Turner, director of the bureau. Mr. Wolflin will immediately assume his duties, and it is believed that his appointment is logically the first step in carrying out the bureau's plans for increasing the general usefulness of the Intermountain Station. Mr. Wolflin holds degrees from the University of Arizona and Columbia University, having specialized in metal-mining methods at the first-named institution. He was a member of the technical staff of the Bureau of Mines from 1910 to 1919, and was for a time in charge of all the bureau's mine-safety cars and stations. From 1919 to 1923 he was superintendent of safety of the Industrial Accident Commission of California, supervising the field work of some twenty-five engineers and inspectors. Mr. Wolflin has also had many years general engineering experience in mining and other commercial fields.

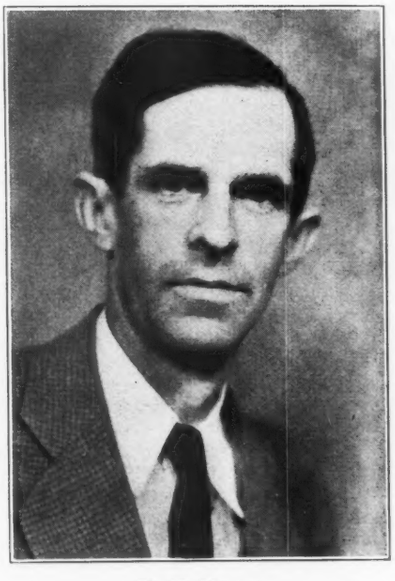
A. W. Hammond has commenced operations at his crushed-stone quarry located near Raymond, Wash. The new plant has a capacity of 60 cu.yd. per day.

Geo. J. Nicholson, vice-president of the Inland Lime & Stone Co. at Manistique, Mich., has returned from a ten-week tour of Europe.

John J. Stanton has been appointed Milwaukee manager, Westinghouse Electric & Mfg. Co., in charge of the Wisconsin and Upper Michigan territory, with headquarters in the First Wisconsin National Bank Building. He joined the Westinghouse organization in 1916 as a salesman in the Wisconsin territory, and since 1926 has been merchandise manager for the Northwest district, with headquarters in Chicago.

W. Forman Bickel, treasurer, Harbison-Walker Refractories Co., Pittsburgh, has been elected a director of the company, succeeding **J. B. Cullom,** who has resigned.

H. H. Morgan, widely known as the designer of many of the outstanding conveyor installations in the automobile industry, is now in Detroit as special engineering representative for the Weller Manufacturing Co. of Chicago and is occupying offices at 10228 Woodward Ave. For the last several years Mr. Morgan has been assistant chief engineer in charge of the drafting room for the Palmer-Bee Co. of Detroit and for many years prior to that was a member of the engineering staff of the Webster Manufacturing Co. (now affiliated with the Weller Manufacturing Co.).



H. H. Morgan.

J. C. Hutchinson has been appointed general manager of the Northwest Magnesite Co. plant at Chewelah, Wash. Mr. Hutchinson had been in active charge of the plant since the death of R. B. Rogers, previous to which time he had been superintendent. C. L. Cole was given the position of superintendent. Mr. Hutchinson has for a number of years been identified with the mining development in the Northwest, and has been associated with the Northwest Magnesite Co. since 1917.

Lee S. Trainor, chief engineer, construction division, National Lime Assn., to whom authorship of the playlet, "Merchandising Lime," was credited in PIT AND QUARRY'S recent account of the lime convention, disclaims all responsibility for it. The credit is due to **Norman G. Hough,** the association's president, who wrote the skit on the basis of a conversation which he overheard in the office of a lime manufacturer.

Frank Ross, superintendent of the Consolidated Oka Sand & Gravel Co., Ltd., of Montreal is recovering from the effects of an operation performed at a Montreal hospital recently.

Obituary

Thomas Newell, was fatally injured Aug. 17 when he went to the rescue of **James Dooley,** trapped in a sand hopper in the yard of the Materials Service Corp. at Chicago. Mr. Dooley had gone into the hopper, to loosen the sand which had jammed at the mouth of the chute and became caught in a cave-in. Mr. Newell, plant foreman, went to his rescue, tied a rope about his shoulders and Mr. Dooley was lifted out. In aiding Mr. Dooley Mr. Newell became trapped. He was unconscious when taken from the sand. Both men were taken to a hospital, where Mr. Newell died while the inhalator squad made futile efforts to revive him.

Kenneth E. Casparis, manager of a stone quarry at Dell Rapids, S. D., and head of the former Casparis Stone Co. of Sioux Falls, S. D., died July 8 of injuries received the day previous in an automobile accident.

Rubert M. Gay, 63, president of the Rubert M. Gay Co., Inc., of New York, N. Y., died Aug. 5 following an operation in Morristown, N. J. Mr. Gay was one of the pioneer developers of air-separation equipment. For the past 15 years he had resided in Boontown, N. J.

Traffic News and Comment

Recent I. C. C. Decisions

Crushed Stone, Sand and Gravel.—A decision which is destined to be cited often in subsequent proceedings and which will probably lead to a change in the level of rates on crushed stone, sand and gravel, in Western Trunk Line, Official and Southern territories, has been made public by the Commission in Docket No. 17,000, part 11-A, Hoch-Smith rates on crushed stone, sand and gravel, and in further hearing on No. 17,000, part 11, Hoch-Smith rates on silica sand. A scale which is the lowest scale of its kind prescribed by the Commission anywhere in the country is provided. The new rates are in conformity with the nine separate findings. The prescribed basis was also approved by the Missouri and Kansas commissions for intrastate application, and for silica sand by the Arkansas, Oklahoma and Texas commissions. Briefly, the nine findings are:

(1) The rates maintained between points in Missouri, between points in Kansas, between points in Missouri and Kansas, and between points in Missouri and Kansas, on the one hand, and points in Oklahoma and Arkansas, on the other hand, were, and for the future would be, unreasonable to the extent that they exceed, or may exceed, the rates set forth in appendix 2, except as otherwise provided by subsequent findings.

(2) The rates maintained on silica sand in box-cars between points designated in finding (1) and interstate between points in Arkansas, Oklahoma, Texas and western Louisiana, were, and for the future would be, unreasonable to the extent that they exceed, or may exceed, the rates set forth in appendix 3.

(3) The rates maintained on silica sand in open-top cars, between points in Arkansas, Oklahoma, Texas and western Louisiana, are, and for the future will be, unreasonable to the extent that they exceed, or may exceed, the rates set forth in appendix 2.

(4) The rates maintained interstate on silica sand between points in Arkansas, Oklahoma, Texas and Western Louisiana, on the one hand, and Memphis, Tenn., Vicksburg and Natchez, Miss., and Angola, Baton Rouge, Harnahan and New Orleans, La., on the other, are, and for the future will be, unreasonable to the extent they exceed, or may exceed, the following basis: In box-cars, the rates set forth in appendix 3, plus 7 c. a net ton when to or from Memphis, and plus 9 c. a net ton when to or from the other named east-bank Mississippi River crossings. In open-top cars, the rates set forth in appendix 2, plus 6 c. a net ton when to or from Memphis, and plus 8 c. a net ton when to or from the other named east-bank crossings.

(5) The interstate rates on crushed stone, sand and gravel, in straight or mixed car-loads, from all points within Missouri and Kansas, located within a distance by air-line of 15 mi. of the passenger station of the Kansas City Terminal Railway Co., at Kansas City, Mo., to industrial and team-track deliveries within the Kansas City, Mo.-Kan., switching district, are, and for the future will be, unreasonable to the extent that they exceed, or may exceed, a rate of 55 c. a net ton.

(6) The interstate rates maintained by carriers on crushed stone, sand and gravel, in straight or mixed car-loads, from points defined in finding (5) to destinations in Kansas and Missouri other than those within the Kansas City switching district and to destinations in Oklahoma and Arkansas are, and for the future will be, unreasonable to the extent that they exceed, or may exceed, the rates established from Kansas City, Mo.-Kan., on the same commodities to the same destinations through the application of the scale set forth in appendix 2.

(7) The rates maintained on sand from Kengle, Price, Gray, Shirk and Joe Station, Okla., also on crushed stone from Price, Gray, Weertz and Garnett, Okla., to destinations in Kansas and Missouri, are, and for the future will be, unreasonable to the extent that they exceed, or may exceed, the rates from Tulsa on sand and crushed stone to the same destinations through the application of the scale set forth in appendix 2.

(8) The minimum car-load weight shall be 90 per cent. of the marked capacity of the car, except that when the car is loaded to full visible capacity the actual weight shall govern.

(9) Where the carriers are under common control or management they shall be deemed a single-line haul, otherwise, joint lines. In computing distances for the application of rates in appendix 3, the shortest route over which a car-load shipment can move without transfer of lading is to be used.

Such carriers as desire fourth-section relief should file applications for such relief.

Commissioner Eastman, concurring in part, said that he preferred the scale prescribed in McGrath Sand & Gravel Co. v. A. T. & S. F., 165 I. C.C. 454, to the one prescribed in this case. It is now proposed to apply the southwestern scales throughout Missouri, including the northern half. If that were done, he said, it seemed unlikely that the scales prescribed in the McGrath case from the Missouri points into Iowa could stand up, for there was no reason why rates should be higher there than in the territory immediately to the south. "And once the movement is started," said Mr. Eastman, "the southwestern scales seem destined to spread throughout western trunk-line territory over into Illinois and then throughout central territory. This, I believe, would be unfortunate."

Commissioner Porter, dissenting, said, "The description of the rate situation contained in this report as applied to sand, gravel and crushed stone throughout the country is convincing to me that the rates prescribed in Sand, Gravel, Crushed Stone, and Shells, 155 I. C. C. 247, for application in the southwest, were far below maximum reasonable rates. All things considered, it is the lowest scale of its kind prescribed by us anywhere in the country. Its single-line rates average only 6.55 per cent. of the southwestern first-class rates, and the average of both the single-line and joint-line rates is only 7.07 per cent. The majority is here extending this low scale of rates into two more states for both intrastate and interstate application, which further aggravates an already bad situation. The rates are even lower than many of the intrastate rates which have heretofore prevailed in those states. After we have extended this scale of rates, as is here done, it logically follows that we must eventually prescribe the same or an even lower scale throughout western trunk-line, official and southern territories, thus replacing in those lower-rated territories rates on these commodities which are now actually or relatively higher, and many of which have been prescribed by us."

Appendix scale 2 is divided into blocks ranging from 10 to 30 mi. in length and runs out at 800 mi. Rates at a few of the intervals on this scale are:

Miles	Single-Line	Joint-Line	Miles	Single-Line	Joint-Line
10	$0.50	$0.65	410	$2.20	$2.25
50	.74	.89	500	2.50	2.50
100	1.00	1.15	620	2.90	2.90
200	1.50	1.60	710	3.20	3.20
320	1.90	2.00	800	3.50	3.50

Appendix scale 3 for application on silica sand in box-cars applies on both single- and joint-line hauls. Rates at a few of the intervals on this scale are:

Miles	Rate	Miles	Rate
10	$0.64	500	$2.92
50	.96	620	3.24
100	1.30	710	3.48
200	1.83	800	3.72
320	2.30	900	3.95
410	2.63	1,000	4.15

Lime.—The Commission has modified the order issued in Docket No. 22,771, Sub. 1, Falling Springs Lime Co. *v.* P. R. R., to permit the defendant carriers to make such groups of destinations involved as will conform with the grouping observed in the publication of the new class rates prescribed in Docket No. 15,879, Eastern Class Rate Investigation.

Fourth-Section Relief

Asphaltic Limestone. — Relief from the long- and short-haul clause of the fourth section has been granted carriers, defendants in I. C. C. Docket No. 23,236, Alabama Rock Asphalt Co. *v.* A. & B. B. R. R., on the rates—from Margerum, Cherokee and Colrock, Ala., to points in official territory described in the order in the above proceedings—on asphaltic limestone, subject to the usual restrictions as to circuity. This order is in response to application No. 14,426, made by Agent Tilford. F. S. C. No. 10,664.

Ground Limestone. — Carriers who were parties to Glenn's Southern Rate Basis, I. C. C. A-725, have been given permission to depart from the long- and short-haul provisions of the fourth section in establishing rates on limestone or marble (except bituminous rock, asphaltic limestone, phosphate rock or gypsum), crushed, granulated, ground or pulverized to fineness to pass through a 5/16-in. screen, including stone dust, in bulk or in bags, car-load minimum weight 60,000 lb., between points in Southern territory considered in Docket No. 13,494, Southern Class Rate Investigation, constructed on the basis of the distance tables of rates and arbitraries set forth in Tables I, II and III of the appendix, subject to the ordinary restrictions regarding circuity. In computing distances for the applications of scales of rates and arbitraries in the following tables, the shortest routes over which car-load traffic can be moved without transfer of lading shall be used.

Table I, Standard Line Scale, gives a distance scale of rates for application on standard lines between points in Southern territory and over routes wholly within such territory, also a basic scale for application to and from points in the Florida peninsula south of the S.A.L., Jacksonville to River Jct., Fla., line, and to and from points on weak or short lines to which arbitraries provided for in Tables II and III herein are to be added. The following rates are per net ton:

Miles	Rate	Miles	Rate
10	$0.70	620	$3.20
20	.80	660	3.30
30	.90	700	3.40
40	1.00	740	3.50
50	1.10	780	3.60
60	1.20	820	3.70
80	1.30	860	3.80
100	1.40	900	3.90
120	1.50	940	4.00
140	1.65	980	4.10
170	1.80	1,020	4.20
200	1.90	1,060	4.30
230	2.00	1,100	4.40
260	2.10	1,140	4.50
290	2.20	1,180	4.60
320	2.30	1,220	4.70
350	2.40	1,360	4.80
380	2.50	1,300	4.90
410	2.60	1,340	5.00
440	2.70	1,380	5.10
470	2.80	1,420	5.20
500	2.90	1,460	5.30
540	3.00	1,500	5.40
580	3.10		

Table II. Florida Arbitraries, gives a scale of arbitraries for distances south of the S.A.L., Jacksonville to River Jct., Fla., line, to be added to the rates for the total distance determined by basis scale in Table I:

Miles	Arbitrary	Miles	Arbitrary
30	$0.30	200	$0.70
60	.40	250	.85
100	.50	300	.90
150	.60	350	.95
Over 350		1.10	

Table III, Weak or Short Line Arbitraries, gives arbitraries for that part of the haul which is over a weak or short line to which arbitraries were accorded in I. C. C. Docket No. 13,494, to be added to the rates for the total distance determined by the basic scale in Table I and to accrue wholly to the weak or short line are not to exceed 25 c. per net ton. F.S.O. No. 10,671.

Fourth-Section Applications

Cement.—F. A. Leland, agent, has asked for fourth-section relief in connection with the establishment of rates on cement from Laramie, Wyo., to points in Arkansas, Louisiana, Oklahoma and Texas. Appl. No. 14,447.

Rate-Committee Dockets

New England Freight Assn.

Crushed Stone. — To meet motor-truck competition carriers propose to reduce the rate on crushed stone [1] from Westfield to Chester, Mass., from 60 to 50 c. a net ton. Docket No. 23,173.

Crushed Stone. — To meet motor-truck competition carriers propose to reduce the rate on crushed stone [1] from West Quincy to Foxboro, Mass., from 95 to 50 c. a net ton. Docket No. 23,193.

Stone Dust.—Carriers propose to reduce the rate on stone dust in bags, car-load minimum weight 60,000 lb., from Westfield, Mass., to Hartford, Conn., from $2.40 to $1.50 a net ton, to meet motor-truck competition. Docket No. 23,202.

Trunk Line Assn.

Crushed Stone. — To meet motor-truck competition carriers propose to reduce the rate on crushed stone [1], from LeRoy and Lime Rock, N. Y., to Warsaw, N. Y., from 75 to 65 c. a net ton. Docket No. 27,437.

Sand and Gravel.—To meet motor-truck competition carriers propose to reduce the rate on sand and gravel,[1] from Portland, Pa., to Columbia, N. J., from 45 to 35 c. a net ton.

Central Freight Assn.

Agricultural Limestone. — Shippers at Woodville and Gibsonburg, O., propose the establishment of a rate of agricultural limestone in box-cars, car-load minimum weight 50,000 lb., to Earling, W. Va., of $3.47 per net ton. The present rate is $4.77. Docket No. 29,058.

Crushed Stone.—Shippers at Monon, Ind., are asking that the rate on crushed stone to Roselawn, Ind., be reduced from 70 to 60 c. a net ton, to expire Dec. 31, 1931. Docket No. 29,055.

Fluorspar.—Carriers propose to revise ex-river rates on fluorspar, car-load minimum weight 40,000 lb., from Ohio River and Monogahela River ports to points in C.F.A. territory, to a basis of 75 per cent. of sixth-class rates. No uniform level of rates is now in effect; in some instances rates are on the brick basis and in some on a considerably higher level. Docket No. 29,065.

Sand.—Shippers at Dickason sand pit (Cayuga, Ind.) are asking that the rate on sand (bank, river and/or torpedo), to Brook, Ind., be reduced from $2.08 to 90 c. a net ton. Docket No. 29,070.

Sand and Gravel.—Carriers propose to reduce the rate on common sand and gravel, from Leeland, Ind., to Gravelton, Ind., from 60 to 50 c. a net ton to expire Oct. 31, 1931. Docket No. 29,083.

Shippers at Attica and LaFayette, Ind., are proposing reductions in the rates on sand and gravel as follows: From Attica to Taylorville, Ill., from 90 to 80 c.; to Clarksdale, Morrisonville, Harvel and Raymond, Ill., from 90 to 85 c.; from LaFayette to Clarksdale, Palmer, Morrisonville, Harvel and Raymond, Ill., from $1.00 to 95 c. a net ton. Docket No. 29,084.

Shippers at R. A. Junction and Sturm and Dillard siding, O., are asking for the establishment of commodity rates on sand and gravel, to points on the main line and branches of the C. & O., Crane to Cotton Hill, W. Va., both inclusive, based on the following mileage scale, Docket No. 29,085.

Miles	Rate	Miles	Rate
175	$1.30	280	$1.75
200	1.40	290	1.85
225	1.50	320	1.95
250	1.60	355	2.05

Slag. — Shippers at Bessemer, Pa., are asking for establishment of a commodity rate of $1.90 a net ton on coal ashes, coal cinders and slag,[1] to Dayton, O. Classification basis now applies. Docket No. 29,078.

Shippers at Youngstown, O., are asking that the rate on ashes, cinders or slag, car-load minimum weight 80 per cent. of the marked capacity of the car, to Lisbon, O., be reduced from 80 to 70 c. a net ton, to expire Dec. 31, 1931. Docket No. 29,082.

Southwestern Freight Bureau

Asphalt Rock and Amiesite.—Carriers propose to establish rates on asphalt rock, natural or coated with not to exceed 5 per cent. of road oil, crushed or ground, and on crushed stone coated with not to exceed 5 per cent. of road oil,[1] from Oklahoma points to destinations in Arkansas, Kansas, Louisiana, Missouri, Oklahoma and Texas, made by use of the scale printed below. This scale was proposed by the carriers and was prescribed by the Interstate Commerce Commission in Docket No. 23,094 for application from Texas producing points to destinations in the Southwest (PIT AND QUARRY, July 29, p. 64), and the Railroad Commission of Texas in Circular 8,825, of June 29, 1931, prescribed the same basis for Texas intrastate traffic. The proposed rates are to be made effective concurrently with the rates from Texas points and will

(*Continued on page 77*)

Latest Portland-Cement Statistics

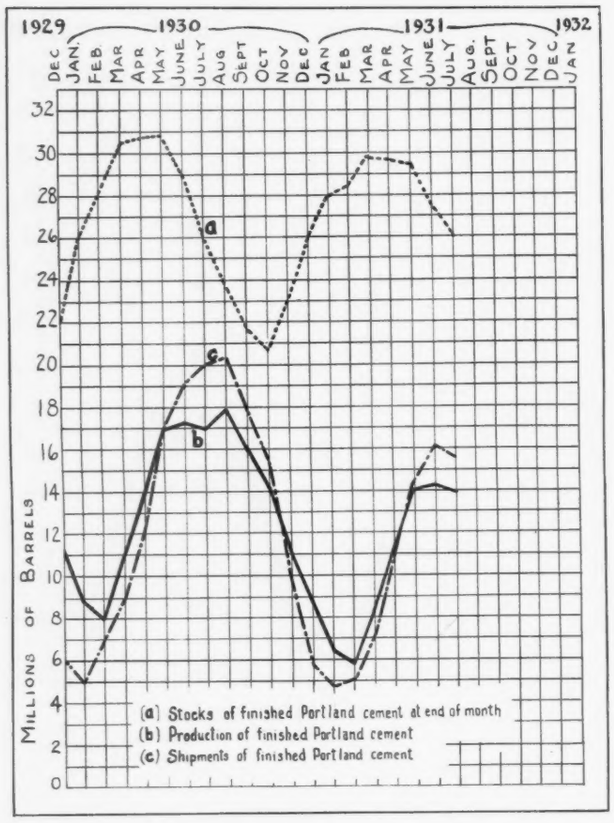

1929
1930
1931
1932
DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG. SEPT OCT NOV DEC JAN
32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
MILLIONS OF BARRELS
a
b
c
(a) Stocks of finished Portland cement at end of month
(b) Production of finished Portland cement
(c) Shipments of finished Portland cement

Chart showing production, shipments and stocks on hand, by months, from December, 1929, to July, 1931.

THE Portland-cement industry in July, 1931, produced 13,899,000 barrels, shipped 15,545,000 barrels from the mills, and had in stock at the end of the month 25,957,000 barrels. Production of Portland cement in July, 1931, showed a decrease of 18.6 per cent. and shipments a decrease of 22.9 per cent., as compared with July, 1930. Portland cement stocks at the mills were 1.3 per cent. lower than a year ago. In the statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants at the close of July, 1931, and of 166 plants at the close of July, 1930. The estimates include increased capacity due to extensions and improvements during the period.

DISTRIBUTION OF CEMENT

Shipped to—	May		June	
	1930	1931	1930	1931
Alabama	129,594	183,572	124,375	138,369
Alaska	2,068	946	2,961	1,100
Arizona	41,429	42,634	41,057	41,110
Arkansas	131,701	187,370	175,644	177,846
California	876,467	628,900	b843,231	646,220
Colorado	109,098	124,139	110,203	99,511
Connecticut	211,543	176,666	191,348	166,357
Delaware	38,168	47,276	59,042	51,926
District of Columbia	96,091	130,588	80,561	141,277
Florida	104,418	82,852	89,285	95,649
Georgia	135,715	156,532	142,722	183,317
Hawaii	29,558	25,580	15,182	22,996
Idaho	22,081	19,917	31,356	25,547
Illinois	1,038,904	882,739	1,212,319	1,069,134
Indiana	637,605	411,373	820,836	616,508
Iowa	1,067,232	611,996	1,126,961	779,351
Kansas	270,178	328,414	245,344	300,175
Kentucky	122,507	231,958	115,398	215,082
Louisiana	311,868	314,748	306,306	422,388
Maine	79,871	54,690	89,475	90,276
Maryland	331,582	199,360	267,222	230,317
Massachusetts	325,910	323,576	286,925	318,456
Michigan	1,022,121	659,977	1,164,439	842,129
Minnesota	501,896	468,010	627,906	625,439
Mississippi	44,775	82,827	51,847	82,243
Missouri	734,806	511,513	727,279	500,949
Montana	37,558	30,139	42,565	35,590
Nebraska	164,983	237,284	235,023	272,654
Nevada	15,133	10,999	16,830	11,041
New Hampshire	66,250	42,169	75,978	43,410
New Jersey	712,665	557,649	763,411	508,242
New Mexico	32,693	42,604	30,382	29,840
New York	2,032,025	2,013,197	2,331,986	2,498,158
North Carolina	133,974	146,249	111,543	163,922
North Dakota	43,316	43,024	63,127	55,251
Ohio	1,091,994	668,196	1,119,351	817,720
Oklahoma	364,053	301,925	353,241	290,304
Oregon	89,175	104,620	99,177	109,997
Pennsylvania	1,559,467	801,763	1,793,487	866,697
Porto Rico	5,265	3,905	250	17,385
Rhode Island	87,710	81,320	75,394	66,438
South Carolina	80,910	256,625	83,713	224,825
South Dakota	51,745	77,241	73,344	110,088
Tennessee	229,121	158,104	284,045	162,661
Texas	583,004	597,840	630,469	586,255
Utah	54,023	30,513	47,830	43,516
Vermont	55,676	24,529	72,329	42,905
Virginia	182,283	183,752	156,599	193,085
Washington	324,551	276,386	347,994	226,264
West Virginia	175,547	128,383	174,962	184,176
Wisconsin	564,324	431,564	751,985	569,655
Wyoming	18,818	17,243	25,877	19,781
Unspecified	13,660	12,082	5,268	1,246
	17,187,109	14,167,458	18,715,384	16,034,778
Foreign countries	36,891	32,542	b65,616	42,222
Total shipped from cement plants	17,224,000	14,200,000	18,781,000	16,077,000

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN JUNE, 1931

Imported from—	District into which imported	Barrels	Value
Belgium	Porto Rico	3,638	$5,530
Canada	Maine and New Hampshire	58	148
Denmark	Porto Rico	5,536	4,188
Japan	Hawaii	1,848	2,219
United Kingdom	New York	21,000	30,870
	Total	32,080	42,955

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN JUNE, 1931

Exported to—	Barrels	Value
Canada	3,836	$15,270
Central America	1,847	5,573
Cuba	5,314	12,772
Other West Indies and Bermuda	2,339	3,963
Mexico	3,088	9,865
South America	25,457	50,155
Other Countries	1,738	10,379
Total	43,619	107,977

RELATION OF PRODUCTION TO CAPACITY

	July		June	May	April
	1930 (*per cent.*)	1931 (*per cent.*)	1931 (*per cent.*)	1931 (*per cent.*)	1931 (*per cent.*)
The month	77.8	62.0	65.4	62.8	52.1
The 12 months ended	66.1	53.8	55.2	56.5	57.7

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1930 AND 1931 (*In thousands of barrels*)

Month	Production		Shipments		Stocks at End of Month	
	1930	1931	1930	1931	1930	1931
January	8,498	6,595	4,955	4,692	27,081	27,759
February	8,162	5,920	7,012	5,074	28,249	28,612
March	11,225	8,245	8,826	7,192	30,648	29,676
April	13,521	11,245	13,340	11,184	30,867	29,715
May	17,249	14,010	17,224	14,200	30,891	29,554
June	17,239	14,118	18,781	16,077	29,364	27,602
July	17,078	13,899	20,153	15,455	26,289	25,857
August	17,821	.....	20,299	.....	23,824	.....
September	16,124	.....	18,083	.....	21,889	.....
October	14,410	.....	15,599	.....	20,697	.....
November	11,098	.....	8,784	.....	23,056	.....
December	8,480	.....	5,688	.....	25,838	.....
Totals	160,905	.....	158,744	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER, BY DISTRICTS, in JULY 1930 and 1931 (*In thousands of barrels*)

District	Production		Stocks at End of Month	
	1930	1931	1930	1931
Eastern Pa., N. J., and Md.	3,211	2,537	1,962	1,593
New York and Maine	1,124	1,047	740	1,083
Ohio, Western Pa., and W. Va.	1,667	1,339	1,432	1,263
Michigan	1,138	610	1,351	1,048
Wis., Ill., Ind., and Ky.	1,854	1,574	1,922	1,199
Va., Tenn., Ala., Ga., Fla., and La.	1,152	1,281	928	685
Eastern Mo., Ia., Minn., and S. Dak.	1,606	1,159	836	710
W. Mo., Neb., Kan., Okla., and Ark.	1,330	935	354	622
Texas	550	675	286	310
Colo., Mont., Utah, Wyo., and Idaho	241	212	229	275
California	891	588	1,109	1,290
Oreg. and Wash.	305	289	535	264
Totals	15,069	12,246	11,684	10,342

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN JULY 1930 AND 1931, AND STOCKS IN JUNE, 1931 (*In thousands of barrels*)

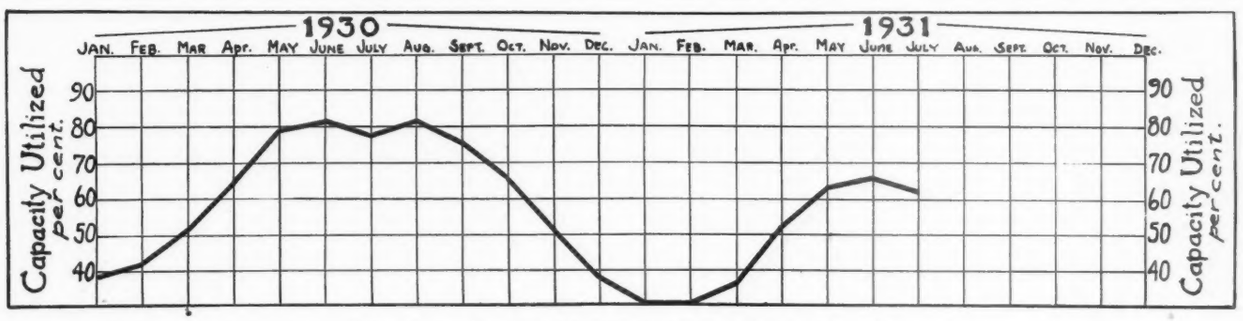
District	July						Stocks at End of June 1931
	Production		Shipments		Stocks at End of Month		
	1930	1931	1930	1931	1930	1931	
Eastern Pa., N. J., and Md.	3,566	2,675	4,085	3,114	5,992	6,026	6,465
New York and Maine	1,249	1,192	1,524	1,436	1,462	1,670	1,914
Ohio, Western Pa., and W. Va.	1,973	1,520	2,358	1,471	3,523	3,559	3,511
Michigan	1,410	983	1,604	1,147	2,618	2,208	2,372
Wis., Ill., Ind., and Ky.	2,255	1,877	2,916	2,275	3,931	3,518	3,915
Va., Tenn., Ala., Ga., Fla., and La.	1,213	1,319	1,327	1,210	1,889	1,588	1,479
Eastern Mo., Ia., Minn., and S. Dak.	1,832	1,414	2,540	1,896	2,495	2,762	3,244
W. Mo., Neb., Kan., Okla., and Ark.	1,405	1,015	1,442	1,102	1,688	1,624	1,710
Texas	585	646	709	696	564	626	675
Colo., Mont., Utah, Wyo., and Idaho	217	219	276	229	501	619	629
California	1,009	670	946	624	1,144	1,158	1,113
Oreg. and Wash.	364	369	426	345	482	599	575
Totals	17,078	13,899	20,153	15,545	26,289	25,957	27,602

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1930 AND 1931

Month	Exports				Imports			
	1930		1931		1930		1931	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	82,387	$293,135	41,199	$115,678	201,609	$207,461	97,057	$132,937
February	64,267	217,798	25,703	88,989	114,455	119,717	22,370	26,250
March	117,563	357,896	54,599	144,579	43,622	59,981	70,532	80,686
April	57,419	200,217	40,478	116,564	140,871	178,226	54,717	61,728
May	57,423	198,170	48,028	140,953	94,696	111,998	20,061	22,794
June	82,077	223,639	43,619	107,977	55,356	74,370	32,080	42,955
July	47,082	166,577	.....	.....	12,404	20,973	.....	.....
August	49,031	167,579	.....	.....	35,323	39,029	.....	.....
September	46,664	153,384	.....	.....	51,096	59,721	.....	.....
October	62,690	190,305	.....	.....	75,284	84,364	.....	.....
November	50,495	151,555	.....	.....	109,124	125,448	.....	.....
December	38,680	134,260	.....	.....	44,157	59,641	.....	.....
Totals	755,778	2,454,515	.....	.....	977,997	1,140,929	.....	.....

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1930 AND 1931 (*In thousands of barrels*)

Month	Production		Stocks End of Month		Month	Production		Stocks End of Month	
	1930	1931	1930	1931		1930	1931	1930	1931
January	10,504	8,129	9,646	10,384	July	15,069	12,246	11,684	10,342
February	10,008	7,473	11,572	11,946	August	15,244	.....	9,275	.....
March	13,045	9,586	13,503	13,318	September	14,577	.....	7,783	.....
April	15,025	11,540	15,164	13,854	October	13,895	.....	7,266	.....
May	16,607	13,159	14,668	13,087	November	11,639	.....	7,758	.....
June	15,895	12,679	13,452	11,837	December	9,484	.....	8,809	.....



Producing capacity utilized by months, January, 1930, to July, 1931.

Output and Value of Portland Cement in 1930

STATISTICS relating to the Portland-cement industry in 1930, compiled by the United States Bureau of Mines from the final returns of the producers for the year, confirm the estimates published by the Bureau of Mines early in January.

Production of Portland cement in 1930—161,197,228 barrels—showed a decrease of 6 per cent. from 1929, and of nearly 9 per cent. from 1928, the highest year of production.

Shipments of Portland cement from mills in 1930 amounted to 159,059,334 bbl., valued at $228,719,756, a decrease of 6 per cent. in quantity and of more than 9 per cent. in gross value. The average factory price per barrel in bulk in 1930 was $1.44, a decrease of 4 cents per bbl. as compared with 1929.

Producers' stocks on hand at the mills increased, reaching a total of 25,838,427 bbl. on December 31, 1930. They were 9 per cent. higher than at the end of 1929, and represented the largest stocks on hand at the end of any year since the beginning of the official statistical record of this item.

From the reports of the producers showing mill shipments of Portland cement into the various states, estimates of per capita consumption in the accompanying table have been compiled. These are at best but approximations, as they represent only the records of mill shipments into states; they do not include the imports, which would increase the consumption in certain states near the Canadian border and the seaboard, nor do they make allowance for a variable but considerable stock of cement at all times in transit, in warehouses at distributing points, and awaiting use at jobs.

The commercial capacity for production of finished Portland cement of the 163 plants active at the end of 1930, and of three plants idle in 1930 but producing within the three previous years, according to manufacturers' reports supplemented by a few estimates, was 270,044,000 bbl. This total includes increased capacity due to extensions and improvements at old plants.

There were no new plants reported as entering production in 1930. The capacity of one plant reported out of business in 1930 and idle in that year and in the two previous years has been excluded from the figures for 1930. The total production for 1930 was 59.7 per cent. of the indicated capacity at the close of the year; the corre-

SHIPMENTS OF DOMESTIC PORTLAND CEMENT FROM MILLS INTO STATES AND PER CAPITA, 1929 AND 1930, IN BARRELS[1]

State	1929		1930	
	Total	Per Capita[1]	Total	Per Capita[1]
Alabama	1,958,089	0.76	1,273,632	.48
Arizona[2]	656,775	1.39	462,560	1.06
Arkansas	1,555,517	.80	1,459,388	.79
California	11,802,278	2.59	9,426,837	1.66
Colorado	891,973	.82	843,983	.81
Connecticut[2]	1,908,868	1.15	1,754,324	1.09
Delaware[2]	365,257	1.50	373,672	1.57
District of Columbia[2]	1,126,946	2.04	1,078,729	2.22
Florida	1,176,495	.83	1,056,549	.72
Georgia	1,423,359	.44	1,561,775	.54
Idaho	261,378	.48	311,800	.70
Illinois	13,490,520	1.82	11,164,248	1.46
Indiana	5,674,739	1.79	4,927,894	1.52
Iowa	5,462,534	2.25	6,411,595	2.59
Kansas	2,605,330	1.42	2,398,123	1.27
Kentucky	1,575,715	.62	1,695,202	.65
Louisiana	1,657,154	.85	2,892,404	1.38
Maine	600,423	.76	835,795	1.05
Maryland	2,426,107	1.50	2,555,386	1.57
Massachusetts[2]	2,908,230	.68	3,090,962	.73
Michigan	11,686,635	2.55	8,625,691	1.78
Minnesota	3,212,554	1.18	3,668,645	1.43
Mississippi[2]	1,028,561	.57	619,649	.31
Missouri	5,620,624	1.60	6,145,380	1.69
Montana	552,357	1.01	319,214	.59
Nebraska	1,470,294	1.04	1,675,904	1.22
Nevada[2]	133,132	1.72	147,243	1.62
New Hampshire[2]	665,519	1.46	559,958	1.20
New Jersey	8,015,348	2.10	6,536,136	1.62
New Mexico[2]	286,473	.72	298,111	.70
New York	21,039,518	1.82	20,147,426	1.60
North Carolina[2]	1,753,324	.60	1,165,162	.37
North Dakota[2]	444,798	.69	337,888	.50
Ohio	10,033,158	1.47	9,698,510	1.46
Oklahoma	3,352,328	1.38	3,396,549	1.42
Oregon	1,017,434	1.13	1,070,341	1.12
Pennsylvania	13,135,444	1.33	13,795,600	1.43
Rhode Island[2]	721,352	1.01	704,943	1.03
South Carolina[2]	1,190,008	.64	1,654,951	.95
South Dakota	530,455	.75	540,867	.78
Tennessee	2,934,953	1.17	2,410,519	.92
Texas	7,584,278	1.38	6,417,951	1.10
Utah	521,047	.98	417,472	.82
Vermont[2]	928,881	2.64	582,495	1.62
Virginia	1,764,760	.69	1,648,052	.68
Washington	2,477,520	1.56	3,102,088	1.98
West Virginia	1,415,161	.82	1,598,843	.92
Wisconsin	5,517,598	1.87	4,974,591	1.69
Wyoming	192,995	.78	178,873	.79
Unspecified	.....	.....	15,865	.....
	168,754,196	1.41	158,029,775	1.29
Exports reported by manufacturers but not included above[3]	1,114,126	.....	1,029,559	.....
Total shipped from cement plants	169,868,322	.....	159,059,334	.....

[1]Per capita figures based on latest available estimates of population made by the Bureau of the Census.
[2]Noncement-producing State.
[3]Includes shipments to Alaska, Hawaii and Porto Rico.

PORTLAND CEMENT PRODUCED AND SHIPPED IN 1929 AND 1930, BY STATES

State	Active Plants		Production Barrels		Increase or Decrease 1930 (*per cent.*)	Production 1929		Production 1930		Average Factory Value per Barrel		Increase or Decrease Quantity 1930 (*percent.*)
	1929	1930	1929	1930		Barrels	Value	Barrels	Value	1929	1930	
Alabama	6	6	5,005,967	4,821,141	− 4	5,228,947	$ 5,911,031	4,689,516	$ 5,829,818	$1.13	$1.24	−10
California	12	12	13,091,899	10,124,219	−23	12,964,746	22,805,576	10,438,479	15,241,089	1.76	1.46	−19
Illinois	4	4	8,242,725	7,934,563	− 4	7,738,208	11,134,538	7,951,680	10,519,162	1.44	1.32	+ 3
Iowa	6	6	6,373,330	7,088,108	+11	6,586,111	9,781,159	7,035,252	10,047,584	1.49	1.43	+ 7
Kansas	7	7	6,739,741	6,012,360	−11	6,855,861	10,041,282	5,633,098	8,254,416	1.46	1.47	−18
Michigan	14	14	13,748,862	11,510,895	−16	13,325,727	18,916,711	10,817,994	14,897,439	1.42	1.38	−19
Missouri	5	5	8,113,304	7,808,543	− 4	7,984,337	11,557,905	8,030,528	11,470,751	1.45	1.43	+ 6
New York	10	10	10,761,368	10,372,742	− 4	10,742,992	15,597,868	10,256,086	15,380,703	1.45	1.50	− 5
Ohio	10	10	9,427,084	8,632,062	− 8	9,144,085	13,427,778	8,185,077	11,956,038	1.47	1.46	−10
Pennsylvania	27	27	39,354,470	37,843,662	− 4	39,309,662	55,600,953	37,968,647	52,712,176	1.41	1.39	− 3
Tennessee	6	6	4,442,249	3,874,549	−13	4,537,601	5,576,235	3,822,598	5,315,693	1.23	1.39	−16
Texas	9	9	7,374,428	6,781,502	− 8	7,083,572	11,805,779	6,792,346	10,782,444	1.67	1.59	− 4
Other States[1]	47	47	37,970,609	38,392,882	+ 1	38,366,473	59,996,974	37,438,033	56,312,443	1.56	1.50	− 2
	163	163	170,646,036	161,197,228	− 6	169,868,322	252,153,789	159,059,334	228,719,756	1.48	1.44	−6

[1]Includes Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

PORTLAND CEMENT MANUFACTURING CAPACITY OF THE UNITED STATES, BY COMMERCIAL DISTRICTS, 1929 AND 1930

District	Estimated Capacity (*bbl.*)		Percentage of Capacity Utilized	
	1929	1930	1929	1930
Eastern Pennsylvania, New Jersey and Maryland	53,983,000	56,019,000	69.9	62.7
New York and Maine	18,449,000	19,009,000	61.9	59.7
Ohio, Western Pennsylvania and West Virginia	26,400,000	28,652,000	67.9	61.5
Michigan	18,535,000	19,241,000	74.2	59.8
Wisconsin, Illinois, Indiana and Kentucky	29,293,000	31,393,000	73.0	64.4
Virginia, Tennessee, Alabama, Georgia, Florida and Louisiana	25,034,000	26,491,000	55.1	48.6
Eastern Missouri, Iowa, Minnesota and South Dakota	22,661,000	24,242,000	69.3	68.9
Western Missouri, Nebraska, Kansas, Oklahoma and Arkansas	17,136,000	17,883,000	72.3	70.0
Texas	9,950,000	10,359,000	74.1	65.5
Colorado, Montana, Utah, Wyoming and Idaho	6,669,000	6,769,000	40.4	33.5
California	23,350,000	22,405,000	56.1	45.2
Oregon and Washington	7,457,000	7,581,000	45.5	54.0
	258,917,000	270,044,000	65.9	59.7

sponding figure for 1929 is 65.9 per cent.

A summary of the monthly estimates of output of Portland cement in 1930, compiled from monthly reports of the producers, was published in the January 28, 1931, issue of PIT AND QUARRY. These estimates, which indicated a production of 160,905,000 bbl. and shipments of about 158,744,000 bbl., were within 0.2 per cent. each of the figures for 1930 here presented.

Reviews of Recent Books

CEMENT CHEMISTRY IN THEORY AND PRACTICE. *By Prof. Hans Kühl. Translated into English by J. W. Christelow. Concrete Publications, Ltd., London, England. Price, including postage, $2.50.* Dr. Kühl has been an important contributor to research work on these subjects, some of his work covering a period of twenty years, and this enables him to write as an expert. He is not backward in expressing his own views on controversial subjects nor in retracting opinions formerly held when new knowledge calls for reconsideration.

The author exposes the misleading conclusions that have resulted from two conditions prominent in much of the cement research work of the past. The first is the examination of the three-component system (lime-silica-alumina) without due regard for the differences caused by the presence of iron oxide acting as a catalyst or flux, and the second is the common procedure of immersing a few grains of cement in a comparatively large volume of water and assuming that the physical and chemical reactions are similar to those that occur in the practical application of cement when the proportion of water to cement is essentially different.

The difficulty of preparing tricalcium silicate from lime and silica alone accounts for the reluctance of some to believe that this compound exists in Portland cement, but the addition of iron oxide causes an essential alteration in the conditions, and it is now accepted that tricalcium silicate does exist in commercial cements, and is in fact the most important constituent. The formation of crystals when a few grains of cement are immersed in water has been the chief support of those who claim that the setting and hardening of cement are due to interlacing of crystals, but Dr. Kühl shows that such a condition is in no way representative of cement-setting conditions in practice, and no one after reading the book can doubt that the induration of cement is a process of gel desiccation.

Two chapters are devoted to the chemistry and manufacture of rapid-hardening cement, and more information on this important subject is given than has previously been available to the public. These chapters should be particularly valuable to manufacturers and their technical staffs. The question is here discussed of the influence of particle size upon strength of cement, and many readers will learn with surprise that there is a limit beyond which fineness of grinding can be continued without advantage to the strength of cement.

Two volumes of value to engineers have just been published by the American Assn. of State Highway Officials. One volume, *Tentative Standard Specifications for Highway Materials and Methods of Sampling and Testing*, contains a comprehensive summary of all specifications in this field that have been adopted by the association. The other volume, *Specifications for Highway Bridges and Incidental Structures*, contains in complete form the standards adopted by the association and it covers everything pertaining to concrete, steel or timber bridges.

Many methods of sampling and testing materials are published in the highway volume for the first time. Seventy-four methods of sampling and testing materials are presented and, since many of the methods are similar to the standards of the A. S. T. M., reference to the A. S. T. M. standard is given in notes under the titles. Changes from A. S. T. M. standards are indicated by footnotes following descriptions of the methods. The section dealing with testing materials is well illustrated.

Although the volume dealing with bridges was primarily compiled to meet the requirements of state highway bridge engineers, it is valuable as an authentic reference and guide to all engineers. The books may be obtained for a nominal sum from the American Assn. of State Highway Officials, Washington, D. C.

Traffic News

(*Continued from page 73*)

cancel all existing rates from Oklahoma producing points to the territory involved. Docket No. 23,328.

Miles	Single-Line	Joint-Line	Miles	Single-Line	Joint-Line
10	$0.70	$0.90	230	$2.00	$2.10
20	.80	1.00	260	2.10	2.20
30	.90	1.10	290	2.20	2.30
40	1.00	1.20	320	2.30	2.35
50	1.05	1.25	350	2.35	2.45
60	1.10	1.30	380	2.45	2.50
70	1.15	1.35	400	2.55	2.60
80	1.20	1.40	410	2.55	2.60
90	1.25	1.45	440	2.65	2.70
100	1.30	1.50	450	2.75	2.80
110	1.35	1.55	470	2.75	2.80
120	1.40	1.60	500	2.85	2.85
130	1.45	1.65	530	2.90	2.90
140	1.50	1.70	560	3.00	3.00
150	1.55	1.75	590	3.10	3.10
160	1.60	1.80	620	3.20	3.20
170	1.65	1.85	650	3.30	3.30
175	1.70	1.90	680	3.40	3.40
180	1.70	1.90	710	3.50	3.50
190	1.75	1.95	740	3.60	3.60
200	1.80	2.00	770	3.70	3.70
225	2.00	2.10	800	3.80	3.80

Texas-Louisiana Tariff Bureau

Sand and Gravel.—Carriers propose to establish a rate of $15 per car on sand and gravel from Sledge and Joyce, Tex., to Texarkana, when not loaded in excess of the marked capacity of the cars. When loaded in excess of the marked capacity the charge per ton for the excess will be in proportion to the charge per ton computed as described above. This rate will not apply as a basing rate or in dividing through rates. Switching charges of other lines in Texarkana to be added. Proposed to meet motor-truck competition. Docket No. S-8, 168-TX.

Cement. — Shippers of cement are proposing that the rates on that commodity from Atco, Eagle Ford, Ft. Worth, Harry's, North Ft. Worth and Houston to Bossier City, La., be established on the basis of the actual mileage to Bossier City in accordance with the formula prescribed in I. C. C. Docket No. 16,845. Docket No. S-8, 174-TX.

[1] The proposed car-load minimum weight will be 90 per cent. of the marked capacity of the car except that, when the car is loaded to its full cubical or visible capacity, the actual weight will apply.

Aerial Tramways Firms Announce Consolidation

B. & B. Aerial Tramways and Automatic Aerial Tramways have recently consolidated and are being handled by the tramway department of the Interstate Equipment Corp. The engineering office for both tramway departments will be located at 25 Church St., New York.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

U. S. Gypsum Income for Six Months $2,241,560

The United States Gypsum Co. and subsidiaries report for the six months ended June 30, 1931, net income of $2,241,560 after depreciation, federal taxes, etc., equivalent after dividend requirements on 7 per cent. preferred stock, to $1.62 a share (par $20) on 1,216,956 shares of common stock. This compares with $2,891,750, or $2.24 a share on 1,170,370 common shares in first half of 1930.

Current assets as of June 30, 1931, were $18,572,107 and current liabilities $1,622,736, compared with current assets of $16,170,760 and current liabilities of $1,621,617 as of June 30, 1930. Earned surplus of $29,229,396 compared with $27,534,363 a year previous.

In submitting his report to the stockholders, Sewell L. Avery, president, stated that "balance sheet and statement of earnings reflect results of a continued decline in building construction. No improvement is expected during remainder of year."

The company has declared the regular quarterly dividends of 40 cents on the common and $1.75 on the preferred stocks, both payable September 30 to stock of record September 15.

International Salt Is Stable Income Producer

Forming the largest combine in the mining, manufacture and selling of salt in the world, with plants strategically situated near eastern, middle western and southern markets, the International Salt Co. has experienced generally rising earnings over the past several years, though last year's net income underwent a small recession. This circumstance found exaggerated reflection in per-share results on the outstanding capitalization at the year-end since, following the three-for-one split-up which took place at the mid-year, the number of shares outstanding was further increased 25 per cent. through issuance to stockholders of rights to subscribe to 60,000 additional shares, at $36 each, in the ratio of one share for each three held.

Thus, International Salt's 1930 net income of $679,480 was equivalent to $2.83 a share on the common stock outstanding at the close of the year, whereas the $687,767 earned in 1929 was equivalent to $3.77 a share on the stock when outstanding, giving effect to the three-for-one split-up. On the average number of common shares outstanding during the year, however, 1930 earnings were equivalent to $3.23 a share. Proceeds from the stock offering were used towards financing the purchase of the Sterling Salt Co. at a cost of $2,500,000. Both companies were mining the same rock-salt vein at Retsof, New York, on adjoining properties. This acquisition is understood to be bringing about appreciable economies in the mining and selling of salt.

Earning power of the company depends not so much on total consumer demand as on trade conditions. Such conditions are now more favorable than those which prevailed at this time last year, and both sales and earnings so far in 1931 are understood to be appreciably ahead of those for the corresponding 1930 period. Salt is used in industry, agriculture, the home, and for medical purposes. Any pick-up in trade would cause larger use of salt, especially in the metallurgical, chemical, refrigerating and packing industries.

The $3 dividend is apparently being earned. Financial condition at the 1930 year-end was strong, with current assets (including $918,964 cash and $571,134 inventories) at $2,180,325, as compared with current liabilities of $460,853. Ahead of the 240,000 no-par shares of common stock are $4,962,500 of first and collateral mortgage 5s, due in 1951.

At present quotations of around 35, the issue is selling for less than 11 times 1930 earnings, based on the average number of shares outstanding during the year. Based upon the present $3 annual dividend rate, the indicated yield is almost 9 per cent.

Johns-Manville Profits Show Decline to July 1

Johns-Manville Corp. and subsidiaries report for the quarter ended June 30, 1931, net profit of $715,657 after expenses, federal taxes, etc., equivalent after dividend requirements on the 7 per cent. preferred stock, to 78 cents a share on 750,000 no-par shares of common. This compares with $230,109 or 13 cents a share in preceding quarter and $998,529 or $1.16 a share in June quarter of previous year.

	1931	1930
Sales	$9,618,774	$13,397,256
Costs and expenses	8,815,570	12,283,021
Balance	$803,204	$1,114,235
Federal tax	87,547	115,706
Net profit	$715,657	$998,529

For the six months ended June 30, 1931, net profit totaled $945,767 after charges and taxes, equal to 91 cents a share on the common stock comparing with $1,740,160 or $1.97 a share in first half of 1930. Consolidated income for the first six months:

Sales	$17,430,261	$25,561,918
Costs and expenses	16,378,674	23,603,985
Balance	$1,051,587	$1,957,933
Federal taxes	105,820	217,773
Net profit	$945,767	$1,740,160

Material Service Takes No Action on Dividends

Directors of Material Service Corporation of Chicago, one of the largest aggregates producers in the metropolitan area, at meeting which was held August 10 took no action on the quarterly dividend of 50 cents on the common stock due at this time.

The company reports for six months ended June 30, 1931, profit of $130,000 after expenses, depreciation and interest but before federal taxes, according to Henry Crown, president. Earnings in July were larger than in any previous month this year, he said, and indications are that profits for the fiscal year 1931 should compare favorably with last year.

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE	COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Common	$0.25 qr.	July 1	July 25	Great Lakes Dredge & Dock	Common	$0.25 qr.	Aug. 5	Aug. 15
Bessemer Limestone & Cement	Class A	$0.50 qr.	July 20	Aug. 1	Ideal Cement	Common	$0.75 qr.	June 15	July 1
Calaveras Cement	Preferred	$1.75 qr.	June 30	July 15	New York Trap Rock	Preferred	$1.75 qr.	June 20	July 1
Canada Dredge and Dock	Common	.....	July 16	Aug. 1	Pennsylvania Salt	Common	$0.75 qr.	June 30	July 15
Canada Dredge and Dock	Preferred	.....	July 16	Aug. 1	Riverside Cement	1st Pfd.	$1.50 qr.	July 15	Aug. 1
Cleveland Quarries	Common	$0.75 qr.	Aug. 15	Sept. 1	Santa Cruz Portland Cement	Common	$1.00 qr.	June 20	July 1
Consolidated Sand & Gravel	Preferred	$1.75 qr.	.....	Aug. 15	Standard Paving & Material	Preferred	$1.75 qr.	.....	Aug. 15
Dolese & Shepard	Common	$1.00 qr.	June 30	July 1	Superior Portland Cement	Class A	$0.27 ½ M	Aug. 23	Sept. 1
Dufferin Paving & Crushed Stone	1st Pfd.	$1.75 qr.	June 19	July 2	Texas Gulf Sulphur	Common	$0.75 qr.	Sept. 1	Sept. 15
General Aggregates	Common	$0.25 qr.	July 1	July 15	Warner Co	1st Pfd.	$1.75 qr.	June 15	July 1
General Asphalt	Common	$0.50 qr.	Sept. 1	Sept. 15	Warner Co	2nd Pfd.	$1.75 qr.	June 15	July 1
					Warner Co	Common	$0.25 qr.	June 30	July 15

Review of Foreign Practice

Numerical Grading for Stone of Varied Shapes

The crushing of rock yields particles that may vary widely in shape—cubical, splintered, flat, etc.—depending to a large extent on the nature of the stone. It is recognized that stone is best for concrete and the like when it consists of a maximum of cubical particles, and specifications usually contain some clause calling for the stone to be, for instance, "as cubical as possible," although there has been no exact definition for this requirement. Methods of determining this quality have heretofore been too cumbrous and too extravagant of time to be practical, but the method proposed here has actually been used in practice with good results. It is based on the principle that the number of separate particles of a given stone and of identical size in a given unit of volume decreases as the number of cubical particles increases. By "identical size" is meant particles between close screen limits, as in the tables. Table I shows the results of a count of particles of

Table I.—NUMBER OF PARTICLES IN STONE SIZES BETWEEN 10 AND 70 MM.

Material	Size	Number of Particles per Liter	
		Best Stone (Cubical)	Poorest Stone (Splintered)
1	60–70 mm.	5	11
2	50–60 mm.	8	18
3	40–50 mm.	15	33
4	30–40 mm.	32	70
5	25–30 mm.	70	150
6	20–25 mm.	125	270
7	15–20 mm.	250	500
8	10–15 mm.	650	1,200

eight different sizes, per liter, in the case of the most cubical and the most splintered stones examined, respectively. Table II is a table of values for stone sizes within broader limits, arrived at by averaging results from Table I.

To test a given sample of stone, the procedure is to make similar counts of the stone under test, and rate it by percentage in comparison with the best and the worst specimens of the foregoing tables. This can be arrived at graphically by scaling the data on millimeter paper, using the best value of the tables as 100 and the poorest at 50, and arriving at a comparative value of the quality of the stone under test. Since the presence of long, rectangular particles that might take the same space as, for instance, two cubes, would throw the results off, it is advisable to pick out such particles before making the test. The exactness of the tests can also be increased, of course, by using sizes with smaller spread between the screen limits.

This method can also be applied to the testing of gravel, in which the minimum number of particles will be

Table II.—NUMBER OF PARTICLES IN COMBINED SIZES

No. from Table I	Size	Number of Particles per Liter	
		Best Stone (Cubical)	Poorest Stone (Splintered)
1+2	50–70 mm.	6.5	14.5
2+3	40–60 mm.	11.5	25.5
3+4	30–50 mm.	23.5	51.5
4+5	25–40 mm.	51	110
5+6	20–30 mm.	113	210
6+7	15–25 mm.	188	385
7+8	10–20 mm.	450	850
1–3	40–70 mm.	9.3	21
2–4	30–60 mm.	18.3	40
3–5	25–50 mm.	39	84
4–6	20–40 mm.	76	163
5–7	15–30 mm.	148	307
6–8	10–25 mm.	342	657

found in the case of pebbles most nearly approaching the spherical, rather than flat, form. One of the interesting possibilities for the use of this method of test is also in tests to determine the exact relations between the shape of the aggregates and the quality of concrete produced with them. — Reichsbahninspektor Rothfuchs in *Zement* 20:660-663, July 9, 1931.

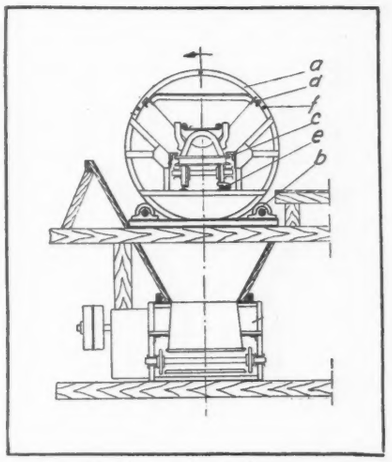
Research on the Effect of Water on Concrete

In a comprehensive report of research at the laboratory of the Engineering College of Stockholm ("Ingenieurwissenschaftsakademie"), general points of view concerning the role of water as material for concrete are discussed, and the nature of the action of the water described; earlier investigations on the subject are described and criticized; basic viewpoints for the measurement of the action of water are introduced; and two new methods of measuring, with which it is possible to obtain a conception of the action of water in the case of drying and freezing, are described. In a subsequent article certain results that were obtained with the aid of the new methods will be discussed.—Stig Giertz-Hedstrom in *Zement* 20:672-678, July 16, 1931.

Rotary-Type Car Dumper Finds Favor in Germany

Unloading of quarry cars to a hopper or feeder can often be accomplished most simply and with least labor by means of a rotary dumper, and for the much-used cars of ¾-cubic meter or about 1-cu. yd. capacity the construction of a car-dumper of this type is quite simple.

As the accompanying drawing shows, the car is pushed into a frame consisting of two heavy circles of angle-iron (*a*) joined by suitable cross-pieces and braces. These rings are supported on two rollers (*b*), the shafts of which turn on roller bearings. To hold the cars fast inside the dumping frame, angle-irons (*c* and *d*) are clamped against the truck-frames and the bodies, and movement of the wheels is prevented by a removable bar (*e*). A sturdy clamp outside the frame itself, not shown in the illustration, keeps the frame from moving while in the normal upright position. In the dumping operation, the whole frame revolves around its axis, turning the car up-end so that



Sketch of the car dumper.

it discharges directly below into the hopper. A rod or handle (*f*) is attached to the end of the dumper, and by means of this one man can easily overturn the entire apparatus. When the car has lost its load the center of gravity shifts to the upper part of the frame as it then stands, so that the dumper easily returns to the upright position.

If more than one car is to be dumped at a time, the dumper frame is built of corresponding length, and dumpers can be built to handle whole trains; in this case they are naturally provided with some mechanical means for revolving the dumper. The dumper can of course be either parallel to or at right angles to the longitudinal axis of the hopper or conveyor which it feeds. The tracks leading to it are usually built with a slight grade so that the cars can be moved into it by hand. The mechanism is most satisfactory if all cars it handles are of uniform dimensions.—*Tonindustrie-Zeitung* 55:805-6, July 9, 1931.

Toronto Firm to Erect $50,000 Concrete Plant

The Dual Mixed Concrete & Materials, Ltd., located at the foot of Bathurst St., in Toronto, Ont., plans the construction shortly of a $50,000 concrete-mixing plant.

Recent Patents

AMERICAN

Excavating

Excavating bucket. Lee S. Wallace, Holt, Ala. No. 1,817,595.

Excavating machine. Asger Eilersgaard, Chicago, Ill., assignor to Link-Belt Co., same place. No. 1,817,809.

Crushing and Grinding

Crushing machine. Edgar B. Symons, Hollywood, Cal., assignor to Nordberg Mfg. Co., Milwaukee, Wis. No. 1,817,044.

Processes

Structural material (light-weight load-bearing concrete). Harry H. Potts, Chicago, Ill. No. 1,816,988.

Method of separating and preparing lime and magnesia. Harvey N. Barrett, Tiffin, O., assignor to Dolomite, Inc., Maple Grove, O. No. 1,816,996.

Unclassified

Materials-handling plant. Carl Bledsoe, Chicago, Ill., assignor to Ogle Construction Co., same place. No. 1,817,343.

Control mechanism for crawler-loader booms. Ferdinand F. Waechter and Louis F. Snyder, Philadelphia, Pa., assignors to Link-Belt Co., Chicago, Ill. No. 1,817,789.

FOREIGN

Blasting

Explosive. The Canadian Industries, Ltd., Montreal, Que., assignee of Frank H. Bergeim, Leonia, N. J. Canadian 313,968.

Cement and Concrete

Process for manufacture of artificial cement. Gracy. French 701,528.

Slag cement of slow set and high strength, and devices for the manufacture of this product. Soc. Anon. U. C. P. M. I. (Union des Consommateurs de Produits Metallurgiques et Industriels). French 703,134.

Coloring Concrete. J. F. Barr. British 347,523.

Process and device for thickening cement slurry with the aid of the waste gases of the rotary kiln. Friedr. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 530,640.

Process for production of a concrete with bituminous aggregate. Ernst Groger, Berlin-Steglitz. German 530,545.

Crushing and Grinding

Machines for breaking gravel, stone and like material. T. Lea. British 347,354.

Means for feeding solid material to pulverizing or like machines. E. W. Green and G. R. Unthank. British 347,372.

Ball or tube mills. E. G. Stone. British 347,413.

Process of and means for the mechanical preparation of pulverized solid materials. M. Madore. British 347,914.

Crusher. Traylor Engineering & Manufacturing Co. British 348,402.

Centrifugal mill. Harzer Achsenwerke G. m. b. H., Bornum a. Harz, Germany. German 530,258.

Apparatus for regulating the air current in air-swept tube mills. Humboldt-Deutzmotoren Akt.-Ges., Koln-Kalk. German 530,117.

Tube mills, and the like, with one or several compartments. Gebr. Proppe Komm.-Ges., Hildesheim. German 530,212.

Air-swept tube mill. Humboldt-Deutzmotoren Akt.-Ges., Koln-Kalk. German 530,255.

Wet-pan grinder, with rotating rollers and fixed grinding surface. Richard Raupach Maschinenfabrik Gorlitz G. m. b. H., Gorlitz. German 530,719.

Pulverizer. Robert Sinclair, Brooklyn, N. Y. Canadian 313,686.

Grinding method and apparatus. The Intercontinental Rubber Co., assignee of George Holmes Carnahan, New York, N. Y. Canadian 313,792.

Drilling

Rock-drills and like fluid-pressure-operated machines. G. H. T. Rayner and P. T. Rayner. British 347,564.

Rock drills. W. W. Triggs (Ingersoll-Rand Co.) British 347,580.

Pneumatic percussive tools. Armstrong, Whitworth & Co., Ltd., W. G., and G. C. Stevens. British 348,002.

Percussive tools. Siemens-Schuckertwerke Akt.-Ges. British 348,271.

Drying

Process and apparatus for drying moist substances. Sachtleben Akt.-Ges. fur Bergbau und Chemische Industrie. British 347,911.

Centrifugal machine for slurries with fine solids, e.g. cement raw slurry. Ernst Knuttel, Kalkberge i. d. Mark. German 529,857.

Double-walled filter cylinder for centrifugal machines. Ramefohl & Schmidt Akt.-Ges., Oelde. German 529,858.

Rotary drier. Joseph Herzheimer, Bedburg. German 530,382.

Drier for flat materials. Coe Manufacturing Co., Painesville, Ohio. German 530,460.

Excavating

Grab buckets. Unruh & Liebig Abteilung der Peniger Maschinenfabrik und Eisengiesserei Akt.-Ges. British 347,472.

Elevators, dredgers or excavators. J. E. Whitehead and Whitehead & Poole, Ltd. British 348,451.

Drag-scraper apparatus and operation. "Hauhinco" Maschinenfabrik G. Hausherr, E. Hinselmann & Co., G. m. b. H., Essen. German 530,038.

Extension boom for excavators. Augustus J. Penote, Shaker Heights, O. Canadian 313,861.

Kilns

Improvements in rotary cement kilns operating by the wet process. Etablissements Poliet et Chausson. French 702,731.

Rotary kilns. J. S. Fasting. British 347,665.

Lime

Process for continuous mechanical slaking of hydraulic lime. Etablissements Poliet et Chausson. French 702,716.

Material-Handling

Conveying apparatus for use in mines. A. Welsh, H. N. Wood and G. Raw. British 347,640.

Dumping device for cars and the like. H. Lees & Co., Ltd. and A. W. Biles. British 347,851.

Method for transporting or storing pulverized coal or other powdered materials. C H C Corner and Imperial Chemical Industries, Ltd. British 348,116.

Conveyor systems. General Electric Co., Ltd., and C. H. Marshall. British 348,236.

Apparatus for hoisting and tipping cars. B. E. Ellson. British 348,304.

Driving-rollers for belt conveyors and the like. G. J. Fisher. British 348,325.

Shaker conveyors. W. A. Logan. British 348,334.

Automatic weight totalizers as applied to conveyors. S. C. Brown. British 348,503.

Bucket-dumping device. Friedr. Krupp Akt.-Ges., Essen a. d. Ruhr. German 530,357.

Apparatus for regulating the movement of cars to and in rotary dumpers. Maschinenfabrik F. Groppel C. Luhrig's Nachfolger, Bochum. German 529,869.

Portable belt conveyor. A T G Allgemeine Transportanlagen Gesellschaft m. b. H., Leipzig. German 530,358.

Sand bin. Maschinenfau-Akt.-Ges. Vormals Beck & Henkel, Kassel, Germany. German 530,361.

Mixing

Concrete-mixers and analogous machines. A. E. King. British 347,327.

Mixing of materials under vacuum. Modern Concrete Development Co., Ltd., and A. C. Knipe. British 347,839.

Multi-stage mixing apparatus. I. G. Farbenindustrie Akt.-Ges., Frankfort a. M., assignee of Kurt Winkler, Frankenthal, Pfalz, Germany. Canadian 313,781.

(*Continued on page 85*)

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited here. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent Office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

Manufacturers' Publications

Each publication listed below contains information of interest to nonmetallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Bearings

SKF Products. 16 p. (Bull. No. 204, SKF Industries, Inc., New York, N. Y.) A deluxe booklet picturing and describing the anti-friction bearings, pillow blocks and shaft hangers manufactured by this company.

Cableways

"Cableway Handles Aggregate for Big Mexican Dam." 3 p. (*Sauerman News* for June-July, 1931. Sauerman Bros., Inc., Chicago, Ill.) Describes and illustrates how a 2-cu.yd. slackline cableway excavator reclaimed the spoil, piled up after excavating the foundation of the Rodriguez Dam, to a crushing-and-screening plant for the production of concrete aggregates.

Electrical Equipment

Circle T—1931. 240 p. (Cat. No. 15. The Trumbull Electric Mfg. Co., Plainville, Conn.) A new catalogue of switches, switchboards, wiring devices and other industrial electrical equipment.

Industrial Control Catalog. 196 p. (Cat. GEA-606 C. General Electric Co., Schenectady, N. Y.) Furnishes information on representative lines of industrial-control equipment. Also contains instructive matter on the care and operation of control devices, wiring diagrams, and reference tables.

Engines, Diesel

Ingersoll-Rand Solid Injection Diesel Engines. 16 p. (Ingersoll-Rand Co., New York, N. Y.) A new bulletin which discusses the advantages of Diesel-engine power. Includes descriptions and illustrations of engines ranging from 150 to 1,200 hp.

Excavators

The Bucyrus Erie 32-B. 24 p. (The Bucyrus-Erie Co., South Milwaukee, Wis.) A new booklet which describes and illustrates the 32-B 1-cu.yd. gasoline, Diesel or electric excavator. The machine is convertible from shovel to drag-line, clam-shell or crane.

Cleveland Bucket-Handling Cranes. 36 p. (Cat. No. C-103. The Cleveland Crane & Engineering Co., Wickcliffe, O.) Describes and illustrates a crane of extremely rugged construction for the handling of bulk materials, particularly cement block and clinker, crushed-stone and coal.

Explosives

"Low-Density Ammonia and Semi-Gelatin Dynamites." 6 p. (*The Explosives Service Bulletin* for July, 1931. E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.) Tells the story of the use of low-density ammonia dynamite and semi-gelatins, with particular reference to their application in quarry blasting and for underground use.

Feeders

Link-Belt Heavy-Duty Apron Feeder. 8 p. (Bull. No. 1351. Link-Belt Co., Chicago, Ill.) Describes and illustrates an apron feeder built of manganese steel for handling lumpy, abrasive or non-abrasive materials. A feature of the publication is the completeness of the tables and drawings, enabling the engineer to make complete preliminary layouts without consultation with the manufacturer.

Lubrication

Farval Automatic System of Lubrication. 4 p. (Lubrication Devices, Inc., Battle Creek, Mich.) Describes and illustrates a system of controlled, automatic lubrication for industrial machines employing a single electrically-driven, central-pumping unit.

Power-Plant Equipment

Capacitators for Power-Factor Correction. 20 p. (Bull. GEA 77D. General Electric Co., Schenectady, N. Y.) Describes and illustrates a line of capacitators, developed after careful research, for the correction and maintenance of a high power-factor throughout power-distribution lines.

Pulverizers

Mikro Pulverizer. (Pulverizing Machinery Co., New York, N. Y.) A loose-leaf catalogue describing and illustrating a pulverizer for grinding materials such as hydrated lime, sulphur, gypsum and other non-metallic minerals to extreme fineness. Illustrations show the machines in actual operating service.

Separators, Magnetic

EC&M Separator Magnets. 8 p. (Bull. No. 910. The Electric Controller & Mfg. Co., Cleveland, O.) Describes the separator magnets made by this concern for the removal of tramp iron from material being processed. Illustrations show their application in crushed-stone, lime and cement plants.

New Developments in Highway Design Studied by Road Builders

The coöperative effort of the American Road Builders' Assn. in furthering studies leading to economy and efficiency in road and street activities on a joint-committee basis with other associations has developed a number of interesting studies.

In addition to the recently announced studies of equipment problems in coöperation with the American Assn. of State Highway Officials, other projects have been begun by which recent practical developments in design and construction will be studied in coöperation with other organizations as follows:

- Asphalt pavements, with the Asphalt Institute;
- Brick pavements, with the National Paving Brick Manufacturers' Assn.;
- Central- and truck-mixed concrete, with the National Ready Mixed Concrete Assn., American Concrete Institute and American Society for Testing Materials;
- Concrete pavements, with the Portland Cement Assn.;
- Compaction of earth fills by various types and sizes of hauling and other equipment, with the National Research Council;
- Low-cost roads, with the Asphalt Institute and the tar industry.

The reports deal with the utilization of highway facts and will contain recommendations, conclusions and trends, a summary of application of findings, details of findings, and a bibliography.

Each report will be reviewed by a committee of specialists selected by the American Road Builders' Assn. after study by the staff engineers of the association. After review by the committee the report will be prepared for presentation with important changes proposed by the committee, and resubmitted to the coöperating association.

The finally approved report will be presented by the committee chairman at the 29th annual convention and road show in Detroit, January 11-15, 1932.

The purpose of this coöperative work is to take up the lag between research and application of such facts the discovery of new facts through in road building.

Houghton Co. to Resume Publication of "Line"

A cheerful sign of the times is the announcement from E. F. Houghton & Co., Philadelphia, of the approaching revival of the *Houghton Line*, the vivid and aggressive little monthly that was for almost twenty years one of the most widely read of the one-man magazines.

The first issue of the new *Line* will appear in September. Its publication was discontinued in 1929 after the death of Charles E. Carpenter, president of E. F. Houghton & Co., who edited it, made it famous, and gave it a circulation of more than a quarter of a million.

Insurance Problems Discussed

New Motor Laws

THE automobile is getting some laws all its own. And with but one exception the new codes place greater responsibility on the drivers of cars.

The automobile emerged so naturally from the horse-and-buggy age that, except for traffic regulations, no one ever thought of it as a special problem legally. Automobile accidents, of course, began shortly after the first cars appeared on the streets, for it seems impossible to bring the human mind and body up to the physical requirements of safe driving. Injured pedestrians and property owners sought redress under the old, unwritten common law that anyone who hurts the person or property of someone else shall pay a cash indemnity for the damage.

Automobiles have grown so numerous, and accidents have become a problem of such serious public concern, however, that state legislatures have found they can not leave the whole matter to the judgment of individual juries, and they are definitely framing new general rules which limit or direct the scope of court and police action.

Changing Conditions

Three distinct new factors in the situation have brought about the changing laws:

(1) Juries are rendering verdicts for larger sums than formerly. A generation ago $5,000 was a large sum of money, and would satisfy almost any claim. In fact it will still do so in such cases as elevator accidents or falls on icy sidewalks. But juries, even though composed of car owners, have developed a curiously hostile attitude toward motorists. In case of doubt, the motorist is held blameworthy, and the damages are set at figures two or three times greater than for any other kind of accident.

(2) The accident rate is increasing; there are more accidents per car than formerly.

(3) The financially irresponsible driver has become a public menace. You feel very bitter when you hear of a person being permanently crippled by some careless driver who has no insurance and no assets of his own with which to pay an indemnity.

State legislatures in the last few years have been making excellent progress toward protecting the public in these new risks. The developments, with which every citizen should be familiar, follow these lines:

Guest Laws

Legislatures do not want to interfere with the tendency of juries to hold motorists for increasingly large damages, because it seems to the public interest to see that pedestrians are indemnified. However, in some ways motorists are becoming the "goats" of smart ambulance-chasing lawyers. In particular, guests in automobiles have been suing their host-drivers, the situation going so far that wives have even collected damages from their husbands. This certainly does not seem fair. If you accept someone's hospitality, you should accept the normal hazards of your host's driving. So nineteen states—California, Colorado, Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Montana, Nebraska, North Dakota, Oregon, South Carolina, Texas, Vermont and Wyoming—have passed laws stating that guests can not recover damages against the drivers or owners of cars in which they are riding unless the drivers are reckless or grossly negligent. This is the only legal tendency in favor of motorists, and is certainly a fair principle.

Compulsory Insurance

The increase in the number of accidents in recent years is a serious problem that has not yet been solved. The trouble has been that not only are there more accidents, a situation which might be expected, but there are more accidents in proportion to the number of automobiles on the streets than formerly. The most spectacular attempt to solve the problem was made by the Massachusetts legislature, which adopted the first and only compulsory liability insurance law, forcing every automobile owner to get an insurance policy before he can obtain a license. The law has been successful, obviously, to the extent that injured parties always have something on which to collect in case of accident. But the compulsory law has not done all that was expected of it. The accident rate has risen, and insurance rates as well. Apparently compulsory insurance can not be used as a substitute for criminal laws with fines and jail terms for reckless driving.

Financial Responsibility

After years of legislative experimenting we now have found the most practical legal aid to safety on the roads in the so-called "financial responsibility" laws, which have been adopted in the following states: California, Connecticut, Delaware, Indiana, Iowa, Maine, Maryland, Minnesota, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Rhode Island, South Dakota, Vermont and Wisconsin. It will be noticed that this list is largely, though not entirely, the same as the list of states having guest laws, which indicates that these are the states that seem to be doing the most aggressive and constructive work in the interest of automobile safety. The principle of financial responsibility can be seen from the following digest of a typical law:

Under this law a motorist may or may not buy insurance, depending on his personal choice. However, in the event of an accident, wherein someone is injured or property is damaged through negligence, an automobile owner must be prepared to pay any judgment rendered against him. If he is not so prepared, his license to drive is revoked. After conviction for such offenses as reckless driving, intoxication and speeding, a motorist must carry public-liability and property-damage insurance. He must also certify to the state that he has such insurance before he will be permitted to drive after conviction. The laws of all states listed above vary only slightly from these main principles.

The financial responsibility law is growing in popularity. It gives good practical protection to pedestrians without being too rigid in its requirements of motorists.

Pennsylvania Purchases 32 Portable Compressors

The O. K. Clutch & Machinery Co. of Columbia, Pa., recently sold the state of Pennsylvania 32 portable air compressors for use by the state highway department.

The large order was repeat business for the company, 11 machines having been purchased by the Keystone state about 18 months ago. According to H. Druschel, manager of the O. K. Clutch & Machinery Co., these original machines cost the state less than one per cent. of the purchase price for maintenance, including spare parts, during the first year's operation. This low upkeep cost was, no doubt, the important factor which induced the state to place its order for the 32 additional machines.

Vertique Marble Co. to Sell Additional Stock

The Vertique Marble Co., of Ishpeming, Mich., will dispose of preferred stock in the amount of $100,000 and a block of 40,000 shares of common stock, no par value, a considerable portion of proceeds to be used for the establishment of new marble quarry near Ishpeming.

Dubuque Stone Products Co. Buys Another Plant

The Dubuque Stone Products Co. of Dubuque, Ia., has acquired the Iowa Fuel & Gravel Co., and plans to make improvements to its floating, storage and loading plant when the Mississippi river dredging season closes, according to Paul M. Nauman, secretary-treasurer.

New Machinery and Supplies

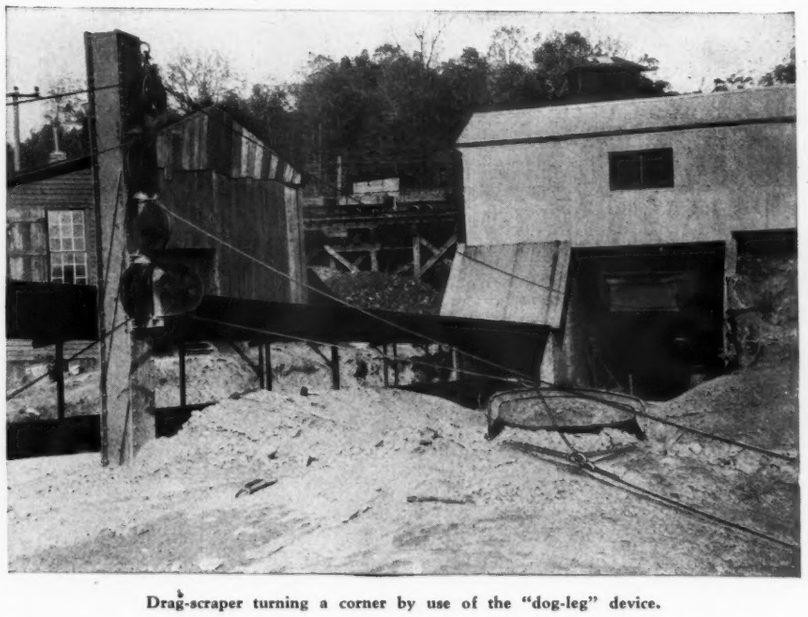
Device Permits Scraper to Turn at Right Angle

Ordinarily the path of a power drag scraper is a straight line from the digging or loading point to the dumping point. There are, however, situations that require the scraper to turn a corner somewhere along its span and work along two paths at approximately right angles to one another, and with a patented "dog-leg" device recently developed by Sauerman Bros., Inc., 434 South Clinton St., Chicago, an operation of this sort is entirely feasible.

Where the customary drag scraper installation consists of a two-drum hoist, two operating cables for inhauling and outhauling the scraper bucket, and two guide-block supports (one at each end of the span), the "dog-leg" installation consists of a three-drum hoist, three operating cables, and three guide-block supports. The third block support is of course at the point where the scraper makes its right-angle turn, and the third operating cable is a "center-haul" cable which serves always to pull the bucket toward the turning point (on both the inhaul and the backhaul). This center-haul cable passes over a guide-block at the turning point to a rod connecting the front and rear bridles of the scraper, so that it pulls on the front bridle during the inhaul but slides to the back of the bucket to pull on the rear bridle during the backhaul. The regular load-line pulls the loaded scraper from the turning point to the dumping point, and the regular pullback cable returns the empty bucket from the turning point to the digging point.

Some of the situations that make an installation of this sort desirable are (1) digging or reclaiming from storage parallel to tracks and turning a corner to mount a car-loading incline; (2) excavating from below ground or reclaiming from a storage room where columns make it impossible to work radially from the hopper or dump; (3) in underground mines, loading cars in a corridor at right angles to the working face; (4) digging lengthwise in trenches and turning to drag the spoil onto the bank. It is also possible to use this device with two tractors, one with a double-drum and the other with a single-drum hoist, instead of the regular three-drum scraper hoist; or, to equip the second tractor also with a two-drum hoist and use the extra drum for operating a rapid-shifting device.

In the accompanying illustration, a 1½-cu.yd. scraper reclaims from a pile under a track hopper, turns a right angle and drags the spoil out to a dump parallel with the tracks.

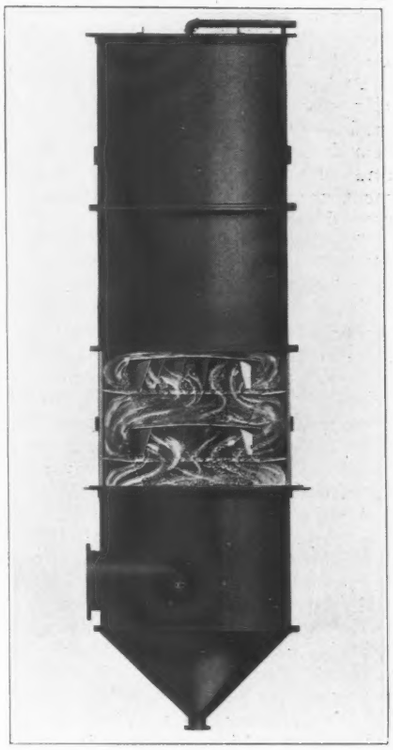


Drag-scraper turning a corner by use of the "dog-leg" device.

Spray Tower Cleans Air in New Dust Collectors

Claude Schneible, 35 East Wacker Drive, Chicago, has recently placed on the market a new wet-type dust collector with many new operating features.

The new multi-wash dust collector as it is called has been simplified to eliminate all moving parts, spray nozzles, pockets and dead zones.



Wet type dust-collector.

Dust-laden air, vapors, gases or other products to be cleaned or recovered are introduced at the bottom of the tower and at a tangent to the periphery. Water or other liquid cleaning or absorbing media introduced at the top of the tower falls in a spray through succeeding plates of the tower, giving an intense, intimate contact with the upward moving air or vapor which has continued to spiral in its course due to the vanes in each plate. There are two washes per plate and standard equipment provides six plates or twelve washes.

This equipment is capable of handling air saturated with moisture and hot gases or fumes. The cleaning action is illustrated by the cut-away view—clean air escapes from the top of the tower and can be returned into the plant or exhausted into the atmosphere.

Multi-wash dust collectors are particularly adapted to use in plants where dust falling outside becomes an evil and for use with ashes, conveying systems collecting dry-feed materials, cement, coal dust or wherever usable vapors or any valuable materials held in suspension should be recovered to prevent costly losses.

Multi-wash collectors can be built of steel, aluminum, copper, wood, enameled cast iron, Monel metal or to suit any condition.

Portable Plant Employs Latest Type Equipment

A portable sand-and-gravel plant for the crushing and screening of material has been placed on the market by the Western Wheeled Scraper Co. of Aurora, Ill.

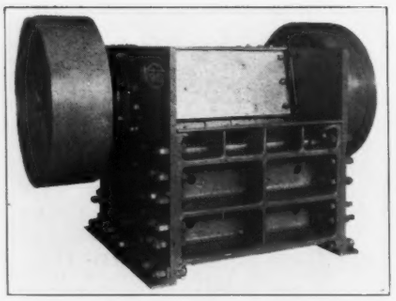
Perhaps the greatest feature of this new plant is the extensive use made of anti-friction bearings, although its efficient built-in conveyors and screening and crushing equipment are certain to insure its widespread use.

The head and tail pulleys of the pit-feed conveyor and all rollers run on Timken bearings. The frame is built of 6-in. channels and is supported and stiffened by truss rods. A steel hopper is mounted on the lower end as the accompanying picture shows. An enclosed clutch controls the operation of this conveyor which is 30 ft. long. A swivel drive is provided which permits the conveyor to operate at a wide angle to the plant.

A built-in feed conveyor is on 20-ft. centers and carries a 24-in. belt. The function of this conveyor is to carry the gravel from the pit-feed conveyor and the crusher returns from the bucket line to the screen. The frame is hinged near the center and has been so constructed in order that it may be swung up out of the way for changing the crusher jaws. The belt is driven by the 18-in. diameter tail pulley at the lower end. An enclosed clutch with ball-bearing slip-ring controls the operation of this conveyor independently of the pit-feed conveyor.

A 3-ft. by 6-ft. double-deck gyrating screen is built into the plant. It is supported at each corner by rubber blocks and is operated by an eccentric shaft through the center of the frame. The short, sharp throw (approximately 5/16 in.) assures sufficient separation even though the material may contain considerable quantities of wet, sticky clay.

Two new Western crushers—a 9-in. by 40-in. primary and a 4-in. by 20-in. secondary—are mounted in the main frame to receive the oversize material from the screen. SKF self-aligning roller bearings are used in these



Crusher used in portable plant.

crushers, and they are safely operated at speeds of 300 r.p.m. for the primary crushers, and 400 r.p.m. for the secondary, with no danger of overheating under any conditions, improper lubrication excepted. A massive shaft, oversize self-aligning roller bearings, and exceptionally strong construction throughout guarantees long life and a minimum of maintenance expense. A longer opening (40 in. compared with the usual 36 in.) and higher speed naturally result in greater capacity.

Crushed rock from both crushers falls into a crusher-delivery conveyor which discharges directly into the bucket line. There is ample clearance for this conveyor to carry any load which the crusher may be able to give it. Timken bearings are used.

A unique and highly efficient mill-type pivoted-bucket carrier is used to return the crushed rock to the built-in feed conveyor. This bucket line completely encircles the frame of the plant. At the bottom the buckets over-lap to form a continuous trough to receive the crushed rock from the crusher-delivery conveyor. The buckets pass up the side and on over the top where they are tripped and dump their loads directly into the feed conveyor. Then they go back down the opposite side and under the plant and so on around.

Power to drive the bucket line is taken from the shaft mounted along the side of the plant. This shaft in turn is driven through a right-angle drive from the shaft which drives the bucket conveyor and built-in feed conveyor. The cut-steel miter gears and SKF self-aligning ball bearings run in oil and are inclosed in dust proof housings. A 2½-cu. yd. storage hopper is built in under the gyrating screen. For loading directly into trucks a 20-ft. delivery conveyor is provided. The conveyor is driven from the same shaft which drives the bucket line. For delivery to a bin, a 48-ft. delivery conveyor is regularly furnished in place of the 20-ft. delivery conveyor. This is a sectionalized conveyor, having head and tail sections and four 9-ft. intermediate sections. It may be lengthened or shortened by adding or removing 9-ft. sections.

A swinging gate and spout are built into the plant for sand rejection. Where surplus sand is present it is only necessary to add a sand screen to the lower deck of the built-in gyrating screen and to provide a delivery conveyor for the rejected sand. The amount of sand rejected is controlled by the operation of a lever connected with the swinging gate. Adjustment of the sand rejector is made while the plant is in operation.

Under the most adverse conditions it is necessary to use only about 1½ lb. of grease in each crusher per shift. The screens should be greased once per shift—the remainder of the plant about once a week.

A 90-hp. 4-cyl. Buda engine is mounted on the frame of the plant as standard equipment. In high altitudes where the rock is unusually hard and the percentage of crushing is high, it is sometimes necessary to use larger engines.

Single-crusher plants are identical in construction with the double-crusher plants except only one crusher, 9 in. by 40 in., is furnished. A smaller engine is standard equipment in the single-crusher plant.

The portable screening-and-crushing plant.

Safety Switch Protects Small Motor Equipment

The Rowan Controller Co. of Baltimore, Md., manufacturers of oil-immersed control equipment for electric motors, recently introduced a combination safety switch and magnetic contactor for use with small ac. motors.

Many engineers have come to the conclusion that fuses give them full protection against shorts and grounds on small a.-c. motors and have been quick to recognize the need which this new switch fills.

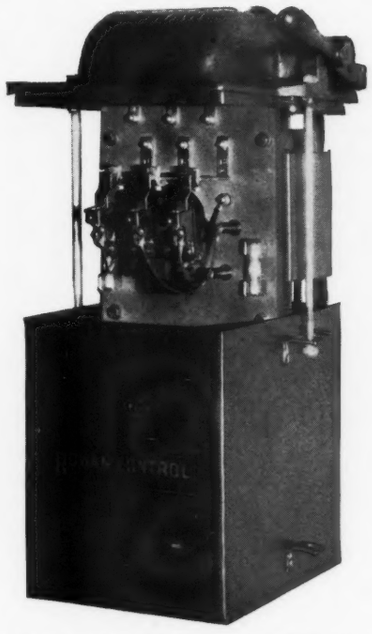
The equipment can be furnished up to and including 5 hp. for 220, 440 or 550 volts. Over-load protection is furnished in other equipment for those engineers who prefer this feature for small motor operation.

The unit is compactly built, so that it occupies a minimum wall space and the fact that it is completely immersed in oil makes it vapor-proof, weather-proof and dust-tight.

Because of its rugged construction and its oil-immersed feature, it has aroused considerable interest among

engineers in gypsum and cement plants.

A bulletin giving a complete description of this new combination safety switch and magnetic contactor



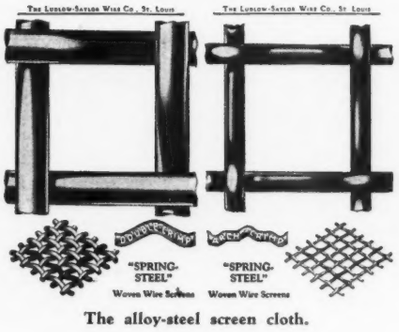
Combined safety switch and magnetic contactor.

has been prepared by the manufacturer and is available for distribution to those engineers interested in this type of equipment.

Presents Complete Line of Alloy-Steel Screens

After five years of experiment and development, the Ludlow-Saylor Wire Co. of St. Louis has rounded out a full line of alloy-steel woven-wire screens in the coarse meshes, suitable for service both as revolving-screen jackets and as vibrating-screen sections, and for various other applications where screens are required for rough, abrasive work.

These newly-developed alloy-steel screens are now being offered to the pit-and-quarry industry under the name of Spring-Steel woven-wire screens, in an 8-page announcement bulletin just released by the manufacturers. This bulletin lists approximately 250 widely-used grades and meshes, ranging from 4-in. openings made of heavy Spring-Steel bars, down to 1/16-in. openings of No. 20 Spring-Steel wire.



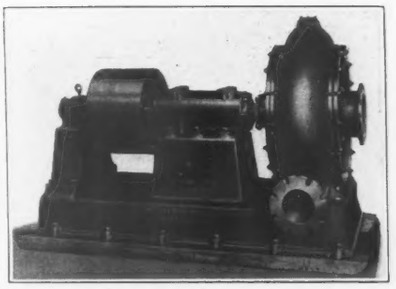
The alloy-steel screen cloth.

Samples are offered to any user of crushing and sizing equipment. Requests should be made to the company at its general offices in St. Louis.

Bearing Arrangement in Pump Absorbs All Shock

The American Manganese Steel Co., Chicago Heights, Ill., has recently added new Type C model to its line of abrasive-materials-handling pumps. This new pump is strictly of Amsco Design, and is made of manganese steel.

Many new features have been included in these pumping units. Bearings are interchangeable in the field, either sleeve or anti-friction types being available. Lubrication is required on main bearings only (except where outboard bearings are used). Impeller clearance and main bearings can be adjusted easily without dismantling and thrust and radial shocks are completely absorbed by new bearing arrangement.



Pump for handling abrasive materials.

The new Amsco Type C pump will meet the strictest present-day demands for long life, high capacity and low first cost as well as low-operating cost, according to the manufacturer.

Recent Patents

(Continued from page 80)

Mixer for stucco compositions. The Canadian Gypsum Co., Ltd., Toronto, Ont., assignee of Fred J. Gough and Frederic D. Pfeffer, Ft. Dodge, Iowa, and William M. McNeil, Chicago. Canadian 313,966.

Sacking

Bag filling and weighing machines. N. S. Jones. British 347,446.

Screening and Separating

Separation of intermixed divided particles. R. Peale, W. S. Davies and A. H. Stevens. British 347,162.

Process and apparatus for removing solid particles from liquids. Dorr Co. British 347,618.

Centrifugal apparatus for the separation and collection of dust from gases. Visco Engineering Co., Ltd., A. Peel and F. C. Smith. British 348,124.

Method of and apparatus for sifting materials. C. A. Gesnel. British 348,-166.

Filter cloths. A. Lemaire. British 348,016.

Slag

Method of utilization of blast-furnace slag. P. P. Budnikoff. British 347,357.

Process for the production of cast products, particularly paving blocks from slag. Dr.-Ing. Heinz Stradtmann, Mulheim, Ruhr. German 530,-099.

Unclassified

Process and apparatus for the manufacture of artificial slate. F. Trvanitschek and J. Frank. French 701,719.

Treatment of silica or compounds or combinations thereof, and the production of products therefrom. I. P. Llewellyn, T. J. I. Craig, A. Kirkham and P. Spence & Sons, Ltd. British 347,223.

Dust-collecting devices for sintering-machines. J. E. Greenawalt. British 347,879.

Apparatus for scattering sand or the like over roads or other such surfaces. J. T. M. Johnston. British 348,190.

Process for the production of meshed products from mineral textiles, such as asbestos. William Neville, London, and Conrad Carnes, Leeds. German 530,098.

Pioneer Manufacturers on Pacific Coast Merge

Victor Welding Equipment Co., with headquarters and plant at San Francisco, and the Kimball-Krogh Pump Co., with plants at Los Angeles and San Francisco, have merged, the new organization being known as the Victor Equipment Co. Both Victor welding equipment and Kimball-Krogh pumps will continue to be sold under their own trade marks and the two original companies will be operated as individual divisions by the newly formed Victor Equipment Co.

Correspondence

To the Editor:

I wish to congratulate you on the sentiments expressed in your editorial entitled "Competition Without Restraints," in the June 30 issue of PIT AND QUARRY. It is going to be necessary, in my opinion, to present all the information possible to the public in general so that the average man may become "making-the-country-safe-for-industry-minded," before we can expect any real results from government aid or supervision in which will finally lie the solution of the problem. It is certainly the foremost problem which this country has to solve.

KAISER PAVING CO.
Oakland, Cal. T. M. PRICE

Portable Plant Employs Latest Type Equipment

A portable sand-and-gravel plant for the crushing and screening of material has been placed on the market by the Western Wheeled Scraper Co. of Aurora, Ill.

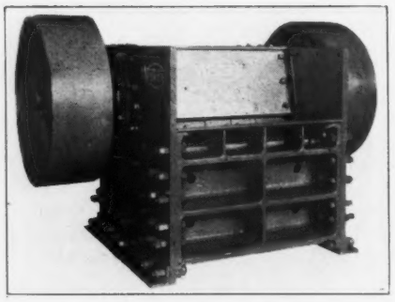
Perhaps the greatest feature of this new plant is the extensive use made of anti-friction bearings, although its efficient built-in conveyors and screening and crushing equipment are certain to insure its widespread use.

The head and tail pulleys of the pit-feed conveyor and all rollers run on Timken bearings. The frame is built of 6-in. channels and is supported and stiffened by truss rods. A steel hopper is mounted on the lower end as the accompanying picture shows. An enclosed clutch controls the operation of this conveyor which is 30 ft. long. A swivel drive is provided which permits the conveyor to operate at a wide angle to the plant.

A built-in feed conveyor is on 20-ft. centers and carries a 24-in. belt. The function of this conveyor is to carry the gravel from the pit-feed conveyor and the crusher returns from the bucket line to the screen. The frame is hinged near the center and has been so constructed in order that it may be swung up out of the way for changing the crusher jaws. The belt is driven by the 18-in. diameter tail pulley at the lower end. An enclosed clutch with ball-bearing slip-ring controls the operation of this conveyor independently of the pit-feed conveyor.

A 3-ft. by 6-ft. double-deck gyrating screen is built into the plant. It is supported at each corner by rubber blocks and is operated by an eccentric shaft through the center of the frame. The short, sharp throw (approximately 5/16 in.) assures sufficient separation even though the material may contain considerable quantities of wet, sticky clay.

Two new Western crushers—a 9-in. by 40-in. primary and a 4-in. by 20-in. secondary—are mounted in the main frame to receive the oversize material from the screen. SKF self-aligning roller bearings are used in these



Crusher used in portable plant.

crushers, and they are safely operated at speeds of 300 r.p.m. for the primary crushers, and 400 r.p.m. for the secondary, with no danger of overheating under any conditions, improper lubrication excepted. A massive shaft, oversize self-aligning roller bearings, and exceptionally strong construction throughout guarantees long life and a minimum of maintenance expense. A longer opening (40 in. compared with the usual 36 in.) and higher speed naturally result in greater capacity.

Crushed rock from both crushers falls into a crusher-delivery conveyor which discharges directly into the bucket line. There is ample clearance for this conveyor to carry any load which the crusher may be able to give it. Timken bearings are used.

A unique and highly efficient mill-type pivoted-bucket carrier is used to return the crushed rock to the built-in feed conveyor. This bucket line completely encircles the frame of the plant. At the bottom the buckets over-lap to form a continuous trough to receive the crushed rock from the crusher-delivery conveyor. The buckets pass up the side and on over the top where they are tripped and dump their loads directly into the feed conveyor. Then they go back down the opposite side and under the plant and so on around.

Power to drive the bucket line is taken from the shaft mounted along the side of the plant. This shaft in turn is driven through a right-angle drive from the shaft which drives the bucket conveyor and built-in feed conveyor. The cut-steel miter gears and SKF self-aligning ball bearings run in oil and are inclosed in dust proof housings. A 2½-cu. yd. storage hopper is built in under the gyrating screen. For loading directly into trucks a 20-ft. delivery conveyor is provided. The conveyor is driven from the same shaft which drives the bucket line. For delivery to a bin, a 48-ft. delivery conveyor is regularly furnished in place of the 20-ft. delivery conveyor. This is a sectionalized conveyor, having head and tail sections and four 9-ft. intermediate sections. It may be lengthened or shortened by adding or removing 9-ft. sections.

A swinging gate and spout are built into the plant for sand rejection. Where surplus sand is present it is only necessary to add a sand screen to the lower deck of the built-in gyrating screen and to provide a delivery conveyor for the rejected sand. The amount of sand rejected is controlled by the operation of a lever connected with the swinging gate. Adjustment of the sand rejector is made while the plant is in operation.

Under the most adverse conditions it is necessary to use only about 1½ lb. of grease in each crusher per shift. The screens should be greased once per shift—the remainder of the plant about once a week.

A 90-hp. 4-cyl. Buda engine is mounted on the frame of the plant as standard equipment. In high altitudes where the rock is unusually hard and the percentage of crushing is high, it is sometimes necessary to use larger engines.

Single-crusher plants are identical in construction with the double-crusher plants except only one crusher, 9 in. by 40 in., is furnished. A smaller engine is standard equipment in the single-crusher plant.

The portable screening-and-crushing plant.

Safety Switch Protects Small Motor Equipment

The Rowan Controller Co. of Baltimore, Md., manufacturers of oil-immersed control equipment for electric motors, recently introduced a combination safety switch and magnetic contactor for use with small ac. motors.

Many engineers have come to the conclusion that fuses give them full protection against shorts and grounds on small a.-c. motors and have been quick to recognize the need which this new switch fills.

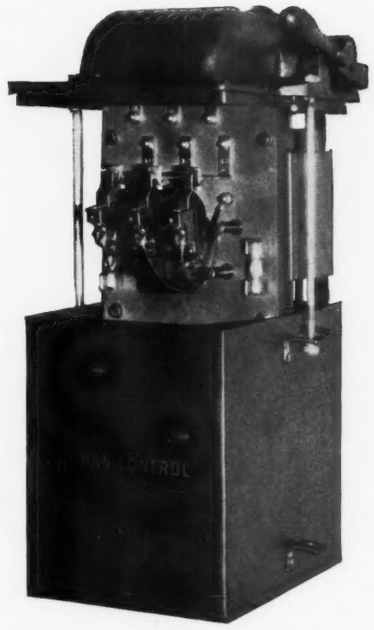
The equipment can be furnished up to and including 5 hp. for 220, 440 or 550 volts. Over-load protection is furnished in other equipment for those engineers who prefer this feature for small motor operation.

The unit is compactly built, so that it occupies a minimum wall space and the fact that it is completely immersed in oil makes it vapor-proof, weather-proof and dust-tight.

Because of its rugged construction and its oil-immersed feature, it has aroused considerable interest among

engineers in gypsum and cement plants.

A bulletin giving a complete description of this new combination safety switch and magnetic contactor



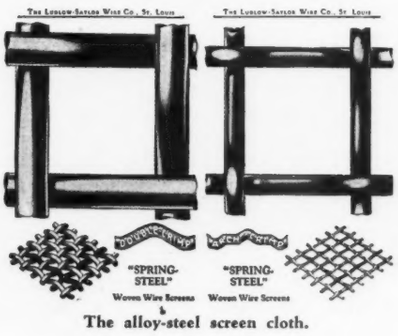
Combined safety switch and magnetic contactor.

has been prepared by the manufacturer and is available for distribution to those engineers interested in this type of equipment.

Presents Complete Line of Alloy-Steel Screens

After five years of experiment and development, the Ludlow-Saylor Wire Co. of St. Louis has rounded out a full line of alloy-steel woven-wire screens in the coarse meshes, suitable for service both as revolving-screen jackets and as vibrating-screen sections, and for various other applications where screens are required for rough, abrasive work.

These newly-developed alloy-steel screens are now being offered to the pit-and-quarry industry under the name of Spring-Steel woven-wire screens, in an 8-page announcement bulletin just released by the manufacturers. This bulletin lists approximately 250 widely-used grades and meshes, ranging from 4-in. openings made of heavy Spring-Steel bars, down to 1/16-in. openings of No. 20 Spring-Steel wire.



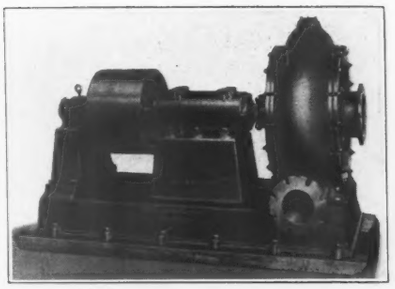
The alloy-steel screen cloth.

Samples are offered to any user of crushing and sizing equipment. Requests should be made to the company at its general offices in St. Louis.

Bearing Arrangement in Pump Absorbs All Shock

The American Manganese Steel Co., Chicago Heights, Ill., has recently added new Type C model to its line of abrasive-materials-handling pumps. This new pump is strictly of Amsco Design, and is made of manganese steel.

Many new features have been included in these pumping units. Bearings are interchangeable in the field, either sleeve or anti-friction types being available. Lubrication is required on main bearings only (except where outboard bearings are used). Impeller clearance and main bearings can be adjusted easily without dismantling and thrust and radial shocks are completely absorbed by new bearing arrangement.



Pump for handling abrasive materials.

The new Amsco Type C pump will meet the strictest present-day demands for long life, high capacity and low first cost as well as low-operating cost, according to the manufacturer.

Recent Patents

(*Continued from page 80*)

Mixer for stucco compositions. The Canadian Gypsum Co., Ltd., Toronto, Ont., assignee of Fred J. Gough and Frederic D. Pfeffer, Ft. Dodge, Iowa, and William M. McNeil, Chicago. Canadian 313,966.

Sacking

Bag filling and weighing machines. N. S. Jones. British 347,446.

Screening and Separating

Separation of intermixed divided particles. R. Peale, W. S. Davies and A. H. Stevens. British 347,162.

Process and apparatus for removing solid particles from liquids. Dorr Co. British 347,618.

Centrifugal apparatus for the separation and collection of dust from gases. Visco Engineering Co., Ltd., A. Peel and F. C. Smith. British 348,124.

Method of and apparatus for sifting materials. C. A. Gesnel. British 348,166.

Filter cloths. A. Lemaire. British 348,016.

Slag

Method of utilization of blast-furnace slag. P. P. Budnikoff. British 347,357.

Process for the production of cast products, particularly paving blocks from slag. Dr.-Ing. Heinz Stradtmann, Mulheim, Ruhr. German 530,099.

Unclassified

Process and apparatus for the manufacture of artificial slate. F. Trvanitschek and J. Frank. French 701,719.

Treatment of silica or compounds or combinations thereof, and the production of products therefrom. I. P. Llewellyn, T. J. I. Craig, A. Kirkham and P. Spence & Sons, Ltd. British 347,223.

Dust-collecting devices for sintering-machines. J. E. Greenawalt. British 347,879.

Apparatus for scattering sand or the like over roads or other such surfaces. J. T. M. Johnston. British 348,190.

Process for the production of meshed products from mineral textiles, such as asbestos. William Neville, London, and Conrad Carnes, Leeds. German 530,098.

Pioneer Manufacturers on Pacific Coast Merge

Victor Welding Equipment Co., with headquarters and plant at San Francisco, and the Kimball-Krogh Pump Co., with plants at Los Angeles and San Francisco, have merged, the new organization being known as the Victor Equipment Co. Both Victor welding equipment and Kimball-Krogh pumps will continue to be sold under their own trade marks and the two original companies will be operated as individual divisions by the newly formed Victor Equipment Co.

Correspondence

To the Editor:

I wish to congratulate you on the sentiments expressed in your editorial entitled "Competition Without Restraints," in the June 30 issue of PIT AND QUARRY. It is going to be necessary, in my opinion, to present all the information possible to the public in general so that the average man may become "making-the-country-safe-for-industry-minded," before we can expect any real results from government aid or supervision in which will finally lie the solution of the problem. It is certainly the foremost problem which this country has to solve.

KAISER PAVING CO.
Oakland, Cal. T. M. PRICE

Legal Information for Operators

Court Fixes Ownership of River-Gravel Rights

Various courts have held that rivers are of three kinds: (1) such as are wholly and absolutely private property; (2) such as are private property subject to the servitude of the public for passage over them, the distinguishing feature between these two being whether they are susceptible or not of use for a common passage; and (3) rivers where the tide ebbs and flows, commonly called "arms of the sea."

In a large number of states the higher courts have held, without qualification, that a grant or conveyance of land bounded by a navigable nontidal river, in the absence of anything in the grant or deed to show a contrary intention, is presumed to carry title to the thread of the stream. This ruling is based on the theory that it could not be anticipated that a seller would desire to retain title to the bed of a stream between the short and the center line thereof. Therefore, a person or company owning property under a deed which describes the land as being bound by a stream of water, actually owns the stream to its center.

For example, in Florida Gravel Co. v. Capital City Sand & Gravel Co., 154 S. E. 255, it was disclosed that the Capital City Sand & Gravel Co. filed suit to enjoin the Florida Gravel Co. from removing sand and gravel from portions of lands lying within and adjacent to the Chattahoochee River. This court stated important law, as follows:

"It is well settled in England, and the doctrine is pretty uniform in this country, that the proprietor of the land on the margin owns the bed over which the river passes; and though it be nominally and in terms bounded on the margin, it extends, by construction of law, to the middle of the stream. In this case, it reaches to the opposite bank, that being the western boundary of the state."

Partnership Liable for Individual Obligations

It is well-established law that all partners are personally and individually liable for the legal debts of the partnership. Therefore, if all members of a partnership are financially responsible the debts of the partnership are distributed equally among them. However, if only one partner is financially responsible and the other members of the partnership are financially unable to pay the legal obligations of the partnership, the partner who is financially responsible is liable for payment of all debts of the partnership.

Another important point of the law relating to partnerships is that any partner may contract obligations for which the partnership is liable, provided such obligations relate to the partnership's business. This is true although none of the other partners are aware that the obligations are being assumed. On the other hand, a creditor can not collect from a partner individually if the partnership is solvent. These important points of the law were explained in the recent higher court case of O'Connor v. Vander Veen, 234 N. W. 101.

In this case it was shown that a member of a partnership purchased cement which was used in furtherance of the partnership's business. At the time the purchase was made the seller was not aware that the purchaser was a member of a partnership. Later, however, the seller was informed of this fact and when the partnership firm became involved in financial difficulties the cement company endeavored to hold one partner personally liable for the debt.

It is interesting to observe that the higher court held that, although an individual partner may be liable for all debts assumed by a partnership, if the partnership and the remaining partners are insolvent, yet if the partnership has assets a creditor is bound to collect from the partnership. This court said:

"If the material was ordered by one partner for the business of the partnership, and so used, the cement company had a right to look to the partnership for pay, even though unaware of the partnership relation at the time of furnishing the material."

Contractor Not Liable for Material Purchase

The law is well established that a person who supplies materials to a contractor, or other agent, knowing that the latter is making purchases for his employer can not recover payment from the contractor.

For illustration, in the late case of Carmichael Tile Co. v. C. A. D. Bayley & Co., 156 S. E. 319, it was shown that a property owner directed a contractor to order building materials from a dealer. Later the owner paid the contractor an amount of money and directed him to pay the dealer's account. The contractor failed to pay and the dealer was compelled to sue the contractor to recover the amount of money paid by the owner. Also, the material man attempted to collect from the contractor a balance on the account owed for materials supplied for use of the owner on the contention that the contractor, in ordering the materials in his own name, became personally responsible for the debt.

It is important to know that the court held the contractor bound to pay to the dealer the amount of money received from the owner, but held that he was not liable for payment of the remainder due on the account since, when the contractor ordered the materials, the material man knew that he was acting as agent for the owner. This court stated the following important law:

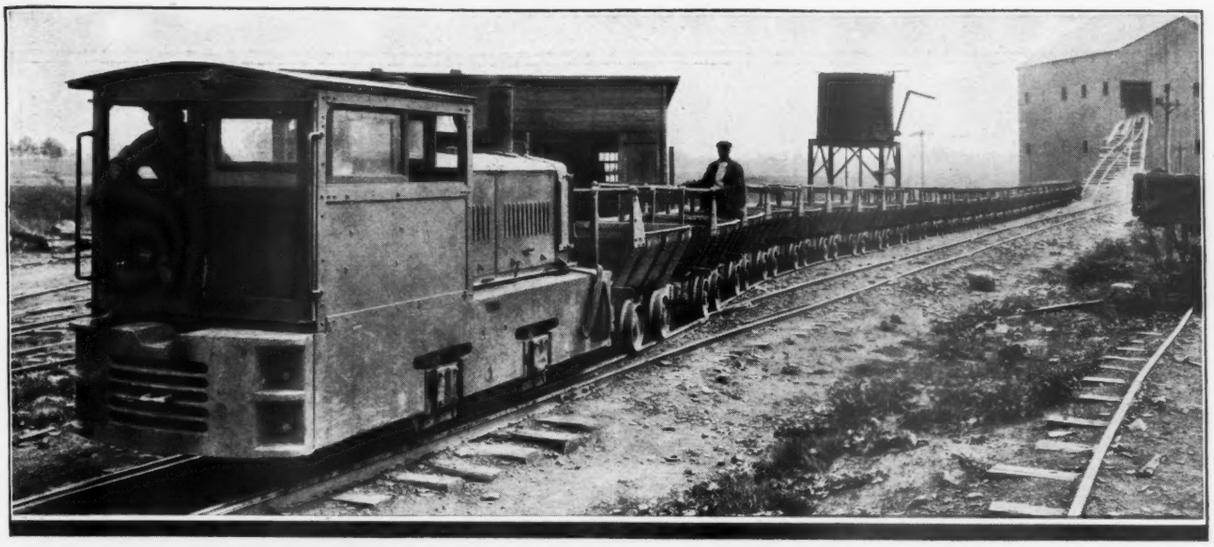
"The two written contracts, properly construed together, clearly show that the defendant (contractor), in buying the material and labor from the plaintiff (seller), was acting as the agent of the owner of the building, and that it (the contractor) was not liable. . . . An action for money had and received lies in all cases where another has received money which the plaintiff (seller) is entitled to recover and which the defendant (contractor) is not entitled in good conscience to retain. . . . In such an action, the law implies a promise on the part of any person who has received the money of another to pay that person on demand."

Sand-and-Gravel Rights Adhere in Sale of Land

It is well known that either a state, county or city may take for public purposes any land, against the will of the owner, and pay a reasonable amount therefor. The amount originally awarded to the owner for his property must include all reasonable use of the land, but special damages later discovered are not allowable.

For instance, in People v. Olsen, 293 Pac. 645, a state condemned certain land for the purpose of constructing a highway. A reasonable valuation for this land was paid to the owner. Later the owner sued to recover special damages for sand and gravel taken from the property for use in building the highway. In holding the property owner not entitled to recover the value of the sand and gravel, the court said:

"Ordinarily the market value of the land which is taken in eminent domain, estimated at the time of the commencement of the action, is the measure of damages for the condemnation thereof. . . . In estimating the market value, any and all purposes to which the land may reasonably be adapted should be considered."



Diamond Portland Cement Hauling

done by 3 WHITCOMBS

- The Diamond Portland Cement Company, located at Middle Branch, Ohio, produces 800,000 barrels of cement yearly.
- Many tons of limestone and shale have to be hauled from quarry to crusher house and away, to keep up this production schedule. Three Whitcombs do it.
- The company owns two 16-ton 36 in. gauge Whitcomb Gasoline Locomotives and one 7-ton Whitcomb Gasoline Locomotive.
- The two 16-ton locomotives haul an average of 950 tons of limestone per day, and the 7-ton machine hauls approximately 100 tons of shale per day.
- Limestone trains consist of 15 cars and travel a distance of 3½ miles, from quarry to crusher house. An average grade of 1½% and maximum grade of 5% are encountered.
- The two 16-ton Whitcombs replaced 3 steam dinkies and do the job much more economically.
- Whatever your hauling requirements there is a type and size of Whitcomb to "haul the load and make the grade."

THE WHITCOMB LOCOMOTIVE COMPANY, Rochelle, Illinois

WHITCOMB LOCOMOTIVES